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Machining the Connecting Rods of Two Well Known Motors

BY FRED H. COLVIN, Editor, *American Machinist*

While the connecting rods for both the Oakland and Studebaker motors are of similar design, there is considerable difference in the methods of machining and the fixtures used. Both methods are of interest to all confronted with problems of large production in this line.

BEGINNING with the manufacture of the connecting rod for the Oakland motor, the main machining operations are outlined in Fig. 1. The methods of holding the work in the fixtures are plainly shown in the halftone illustrations. The rough drilling of the large hole is done under a six-spindle drilling machine, two spindles of which are shown in Fig. 2. The fixtures are of the semi-box or open-side type, the top plate being cut away to allow easy handling and observation. The centering of the large end of the rod is done by a hollow coned center which is threaded on the outside and provided with the handwheel or nut *A*. The small end is centered by a sliding V-block *B*, which resists the tendency to turn under the torsion of the drill used. These same drilling fixtures are used in the next operation and for that reason carry a bushing for the roughing drill for the small end. After the large hole has been rough drilled the fixtures are slid around on the track shown in Fig. 3 to the machine which backs up against the one used for rough drilling. On the way from one machine to the other the fixture lies under the air jet *A* so that all chips can be readily blown out. The second machine, carrying six spindles, drills three connecting rods at once, rough drilling the small ends and finish boring the large ends with the fluted boring tools shown. The rods clamp the piston pins in the small end. This clamping, how-

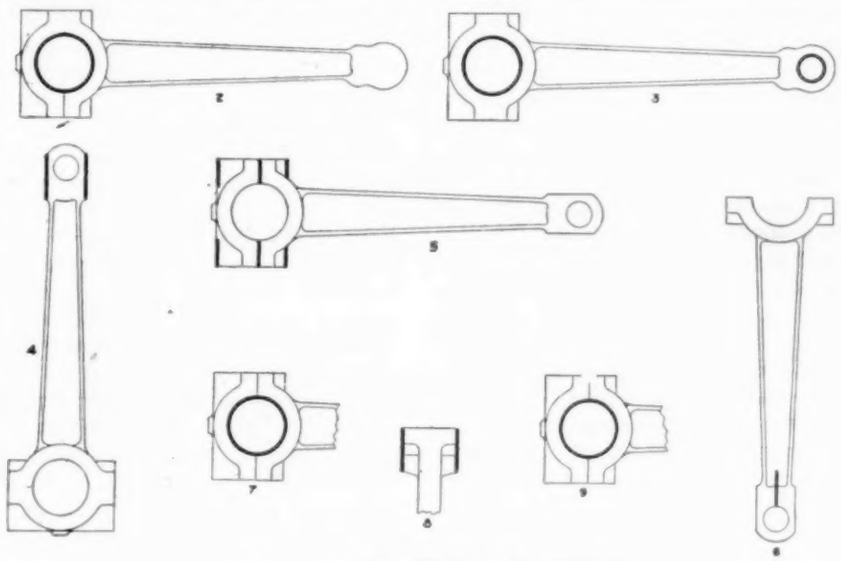

FIG. 1. TRANSFORMATION SHEET

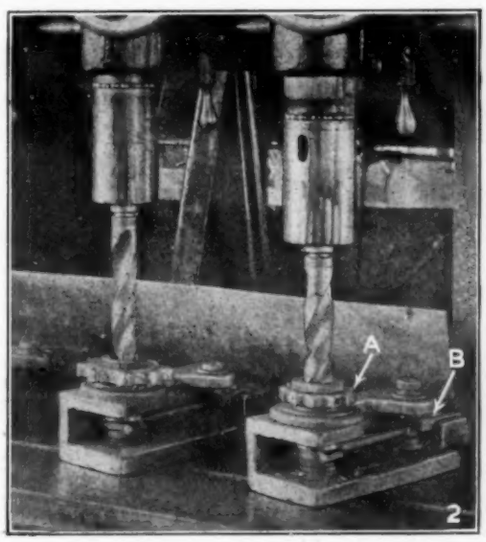

FIG. 2. ROUGH-DRILLING LARGE END

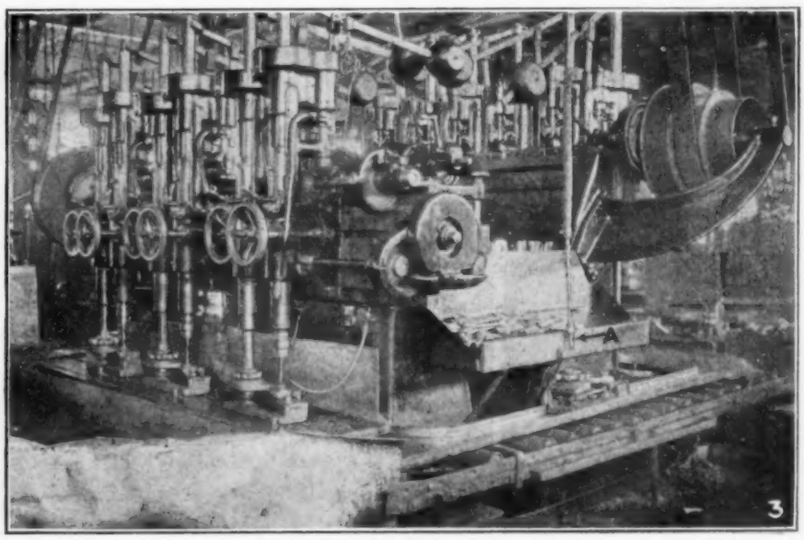

FIG. 3. THE SECOND DRILLING

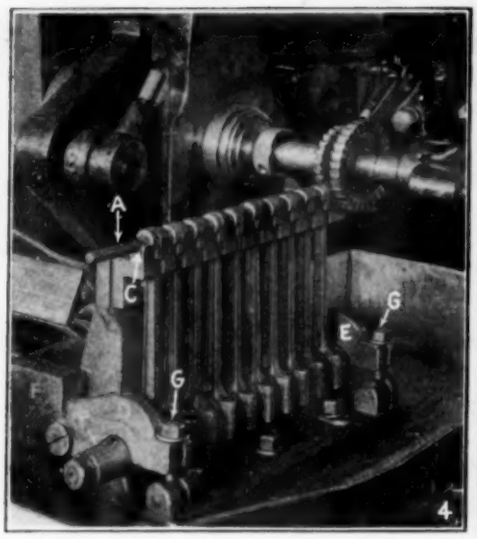

FIG. 4. MILLING SMALL END

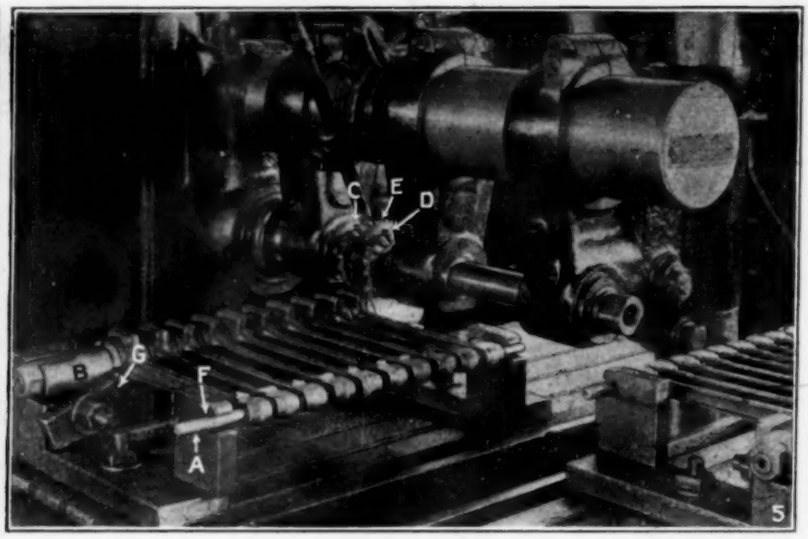

FIG. 5. SAWING OFF THE CAP

ever, is done by splitting the small end of the connecting rod down to the center of the web instead of putting it in at an angle from the side, as is usually the case. In order to flatten the sides of the small end for the clamping screw, a pair of straddle milling cutters are used, as shown in Fig. 4. The rod *A* is slipped through the holes in the small ends, while the bar *B*, having collars on the end, clamps the large ends of the rods firmly together in lots of ten. The ten rods are then placed in the fixture shown so that the rod *A* rests in a V-block, *C*, at each end, while the arms *D* and *E*, hooking over the bar *B*, hold the connecting rods firmly in place for the milling operation. The counterweights *F*, at the back of *D* and *E*, automatically lift the clamping arms out of the way as soon as the bolts *G* are released.

The same batch of ten connecting rods, still held in place on the rod *A* and the bar *B*, are then taken to the manufacturing milling machine, Fig. 5, and held in the fixture shown. This machine carries two milling cutters, *C* and *D*, which face the seats for the bolt heads and nuts and the slitting saw *E*, which at the same time cuts off the cap on one side.

The work tables are then swung 180 deg. so as to bring the other fixture into position, and, while the next ten connecting rods are being milled, the first batch is released and turned over so that the bolt bosses on the other side can be milled, and the separation of the caps completed. It will be noted that, as in the preceding case, the rod *A* fits into a suitable notch *F* and the bar *B* is located and clamped in the proper position by means of the angle block shown and the strap *G* clamps it in place. This is an excellent example of practically continuous milling.

Next comes the splitting of the small end of the rod as shown in Fig. 6, the bolt hole having already been drilled and tapped, as can be seen. This is done in a simple fixture on a hand milling machine, the small end of the rod fitting over a pin at *A*, while the other end of the pin *B* positions the large end.

Babbitting the Bearings

After the connecting rod bolt holes have been drilled and reamed, the rods are ready to be babbitted, this being done on an interesting revolving table, as shown in Fig. 7. This table can accommodate thirty-two connecting rods, each block *A* being screwed to the table and carrying two fixtures, as at *B* and *C*. These fixtures each consist of an arbor of the proper diameter, having a head which fits easily into the slot shown. The arbor has a handle *D*, by which it can be easily put into place and removed. Over it is slipped the base

FIG. 6. SLOTTING THE WEB

FIG. 7. BABBITTING LARGE END

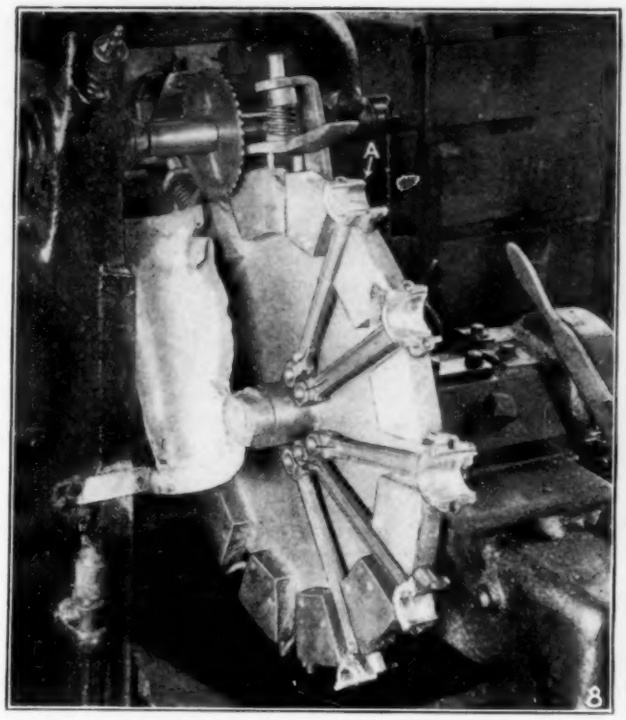

FIG. 8. TRIMMING SURPLUS BABBITT

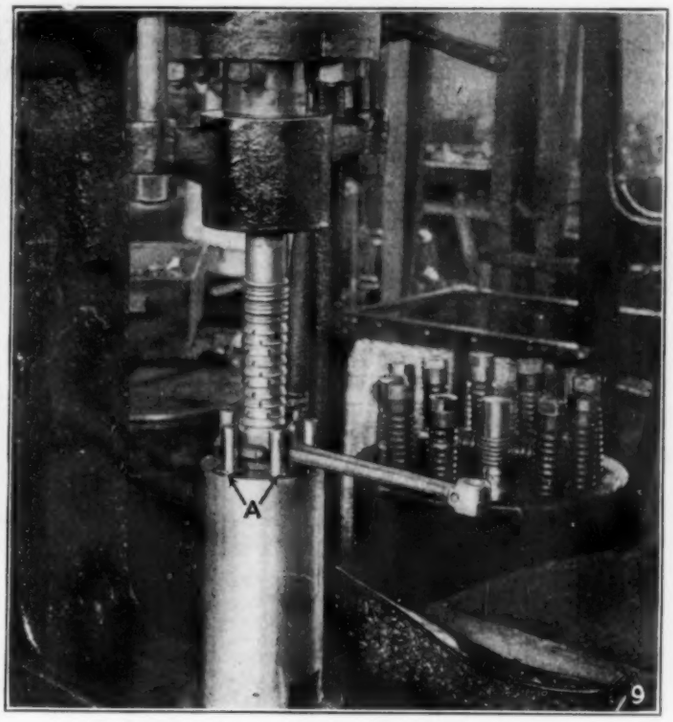

FIG. 9. BROACHING THE LARGE BEARING

ring *E*, which is recessed to guide the large end of the rod from the outside.

Then the rod is put in place over the arbor, a quick acting clamp *F* holding the cap in position, and the top ring put in place. As the table revolves in front of the three babbitt furnaces shown, the bearings are poured and by the time the table is halfway around the metal is set sufficiently for the rod to be removed. The rod and the mold are pulled out of the block by means of the handle, and the arbor forced out in one of the arbor presses shown. This makes a very convenient arrangement and allows the rod to be handled rapidly.

The surplus babbitt is trimmed off on the special device shown in Fig. 8, rigged up on a hand milling machine. The milling machine spindle carries a saw and the rods can be handled very quickly, as it is only necessary to place them in position on two dowel pins which fit into the bolt holes. Before the rods come in contact with the saw they run under the shoe *A*, which is held in position by sufficient spring pressure to prevent their lifting under the action of the saw. After passing under the shoe they fall off the pins by their own weight and drop into a box to be carried to the next department.

The babbitt bearing is finished by broaching and burnishing under an hydraulic broaching press, as shown in Fig. 9. Short push broaches are used, the finishing of the bearing being accomplished by the burnishing rings at the upper end of the broach. Several broaches are used in each set, so as to reduce the cut per tooth to the desired amount. The pins in the top of the column *A* are so located as to hold the large end of the rod firmly in position and at the same time allow it to be easily handled in and out of the fixture. The broaches used are shown standing upright in their holder at the right.

The Studebaker Method

Although the connecting rods dealt with in this article are of almost the same type as the Oakland, both the fixture design and the method vary to some extent.

THE Studebaker connecting rod also clamps the piston pin by means of a split web, although the splitting fixture and the machining of the clamping surfaces are quite different from that in the Oakland plant, as previously shown on page 829. The transformation sheet, Fig. 1, gives an outline of these operations. The first operation is to spot-face the large end of the connecting rod in the fixture shown in Fig. 2. This illustration shows the type of fixture and the facing cutter used. The clamping slide *A* is shown in its outer position. When pushed in, the latch *B* hooks over the pin *C*, after which the block is screwed into place, using the wheel *D*. The same fixture is used in facing both sides.

The large hole is drilled in a somewhat similar fixture shown in Fig. 3. The large hole is located by the piece *A* and held against it by a V-block on the end of the screw *B*. The same forms of sliding block and latch are used as in Fig. 2. The small end of the rod simply fits into the block *C* which aids in resisting the turning movement of the roughing drill.

Drilling Small End of Rod

The small end of the rod is next drilled in the fixture shown in Fig. 4, this being of the same general design as the others. The bored hole of the large end fits over the half round stud *A* and is forced against it by

a suitable V-block operated in the same manner as the previous fixtures shown.

After this the small hole is reamed, the edges of both holes chamfered and the small hole finished by broaching. Then the anchor slots for holding the babbitt bearing metal are broached in the Lapointe machine, clear the outside of the small ends. Two passes are required, the rod being turned over so as to have the slots equal on each side.

The hole is then tapped for the clamping bolt, after which the rods are ready for the conveyor shown in Fig. 7, which carries them to the upper floor for tinning and

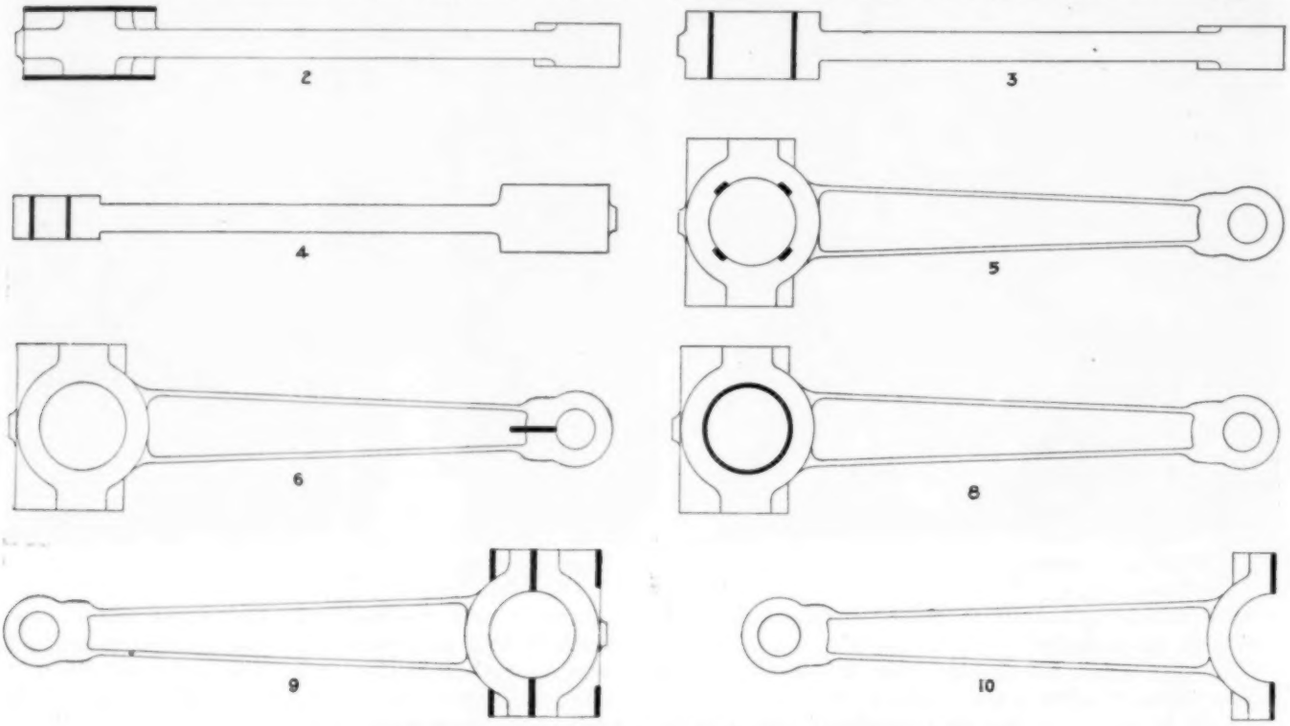

FIG. 1. TRANSFORMATION OF STUDEBAKER CONNECTING ROD

shown in Fig. 5. The rod is positioned on the pin *A* and four anchor slots are cut by the broach *B*. This gives an anchor near each end of the bearing surfaces on both the rod and the cap. The inclined chute or conveyor *C* brings the rod to the broaching machine and shows one of the methods of handling which are quite common in the Studebaker shops.

Both sides of the large end are then chamfered on the outside, and the bolt holes drilled in the two sizes necessary for the small end of the rod. The small end is then spot-faced, after which the web slot is sawed in the small end, as shown in Fig. 6.

The rods are sawed in pairs, being supported on the inclined surface shown, so that the slitting saws will babbitting. As the rods come from the slitting operation it is only necessary for the operator to remove them from the fixture *A*, Fig. 7, and place them in the chute *B* from which they slide into the conveyor *C* and are automatically carried up to the babbitting department. Incidentally, this same illustration shows the use of inclined chutes for the piston department at *D*.

On reaching the upper floor, the connecting rods are first tinned and then babbitted on the revolving table shown in Fig. 8. The small end of the rod is located by the pin, as at *A*, while the large end is centered by the babbitt mold *B*, which carries a mandrel that governs the inside diameter of the hole. The outer or large end is fastened into position by means of the screw *C*. After

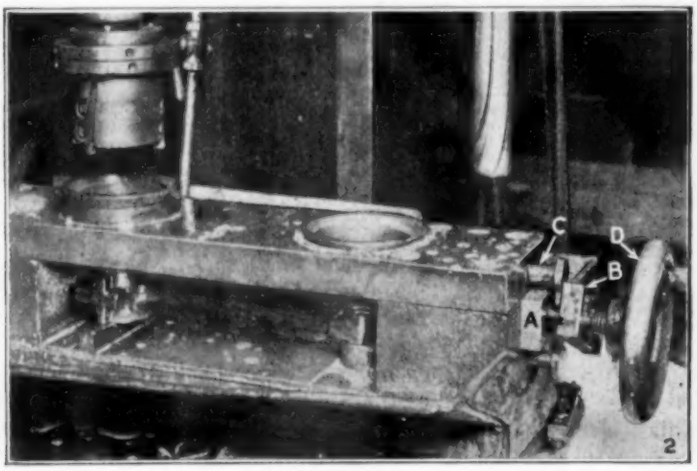

FIG. 2. SPOTFACING THE LARGE END

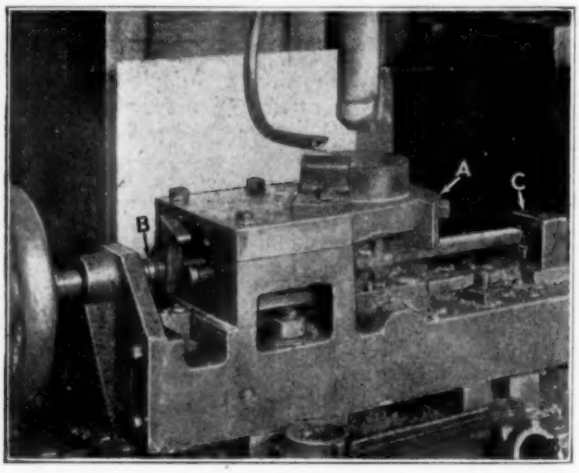

FIG. 3. BORING THE LARGE END

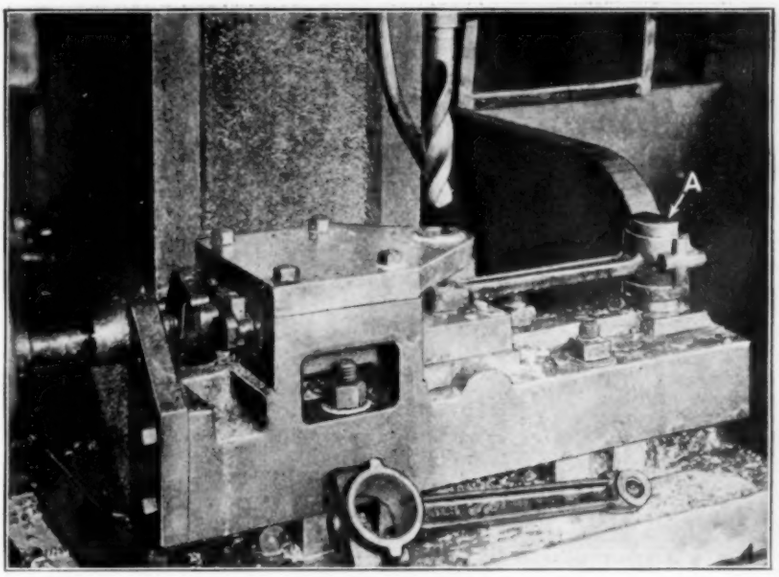

FIG. 4. DRILLING THE HOLE IN THE SMALL END

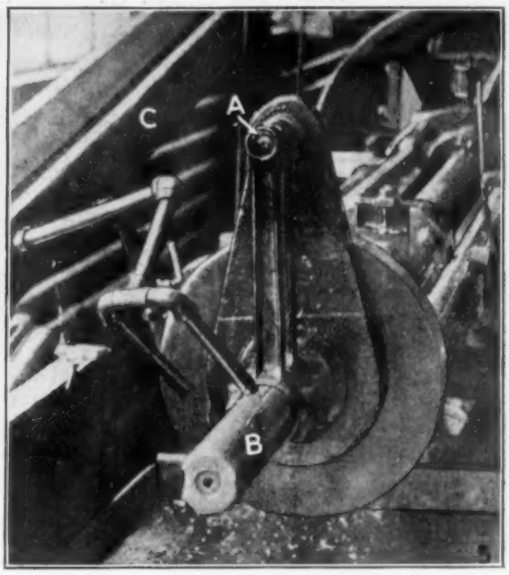

FIG. 5. BROACHING ANCHOR SLOTS FOR BABBITT

babbitting, the rod and mold are removed, the top of the mold being taken off while the mandrel is forced out under the arbor at *D*. The pigs of babbitt metal shown at *E* give some indication of the number of rods handled in this department.

It will also be noted that contrary to most practice, the cap has not as yet been removed from the connecting rod itself. The babbitt is then rough reamed and the end of the babbitt faced. The babbitt bearing is then finished by broaching, a blank end on the broach preventing more than 0.001 in. being removed by the teeth of the broach. The surplus babbitt is then trimmed off and the rods go to the Cincinnati duplex milling machine shown in Fig. 9. Here all four bolt bosses are faced and the cap cut from the rod. The rod is positioned by the flattened stud *A* while the large end is supported on both sides of the slot by a swinging clamp *B*. The post *C* comes through the large end of the rod and the screw *D* locks the fixture together, so that the rod is firmly held during the milling operation.

Another departure from usual practice is the drilling of the connecting rod bolt holes in both the rod and cap, after they have been separated, instead of while they are all one piece. After the bolt holes are reamed, all holes are drilled and countersunk, the bottom of the cap being drilled for the oil splasher and all grooves milled on both rod and cap. The next operation is to first mill the bearing end of the connecting rod in the fixture shown in Fig. 10. This carries four rods at one setting, two being milled at one pass of the milling cutter *A*. The semi-circular block *B*, which is somewhat less than a half cylinder, is fastened solidly to the fixture. The pin *C* is mounted in a slide *D* which is controlled by the screw *E*. After a rod has been placed in position, the screw *E* forces it against the block *B* and not only positions it, but holds it firmly in place. At the same time the semi-circular block *F*, which is also a part of the slide *D*, forces the lower rod against the pin *G*. The indexing table allows the whole fixture to be rotated so as to present both ends to the milling cutter *A*.

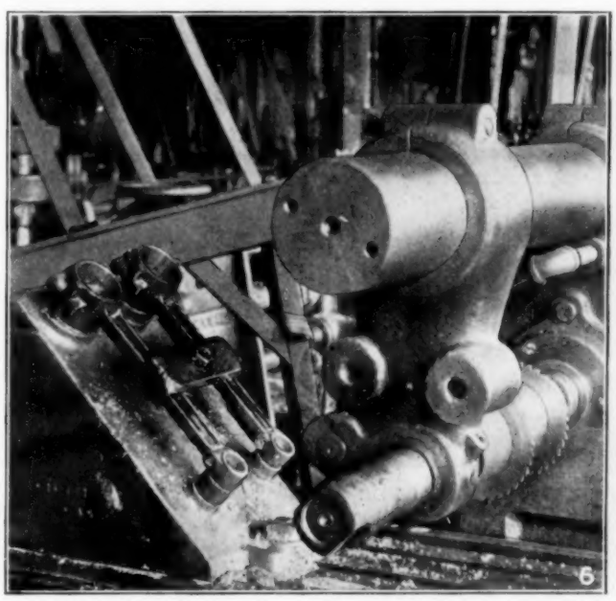

FIG. 6. MILLING SLOT FOR CLAMPING PISTON PIN

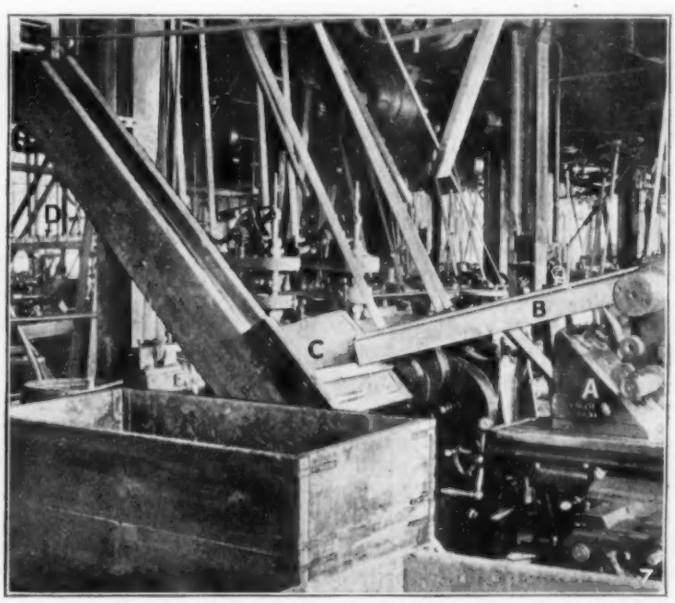

FIG. 7. CONVEYORS HANDLING CONNECTING RODS

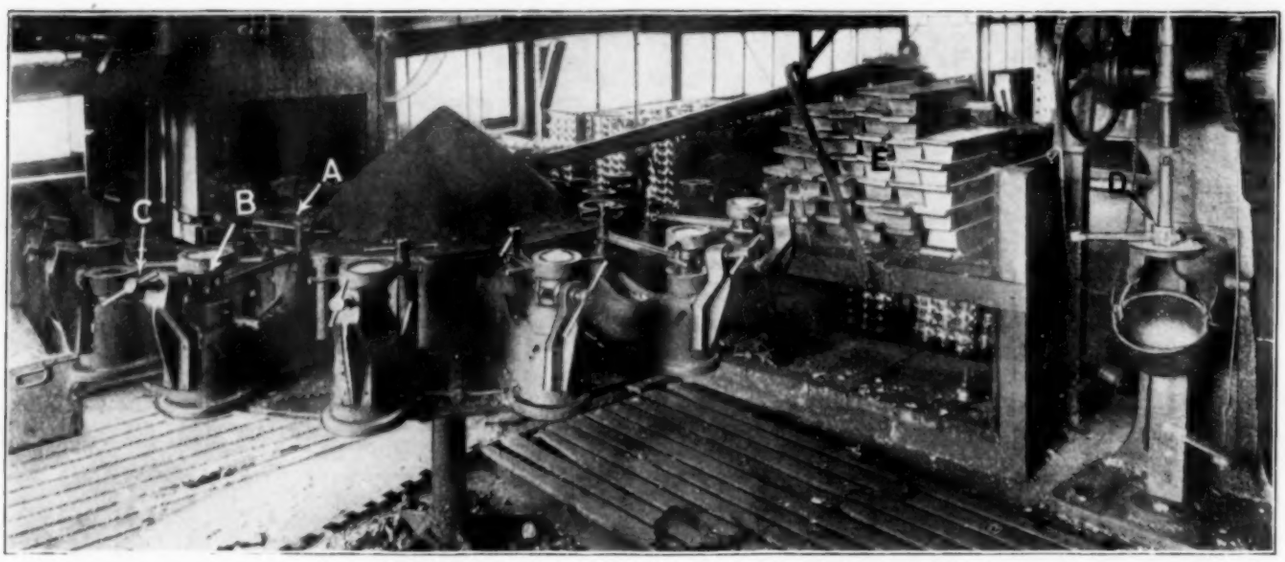

FIG. 8. BABBITTING THE LARGE END OF ROD

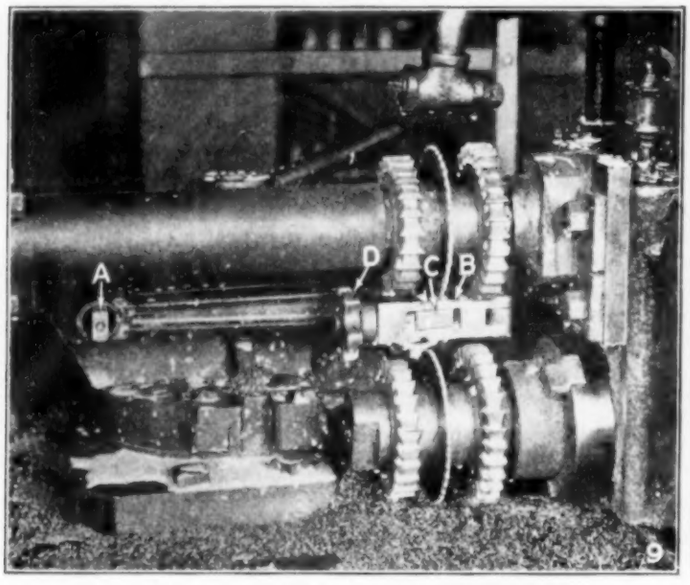

FIG. 9. SEPARATING THE CAP FROM THE ROD

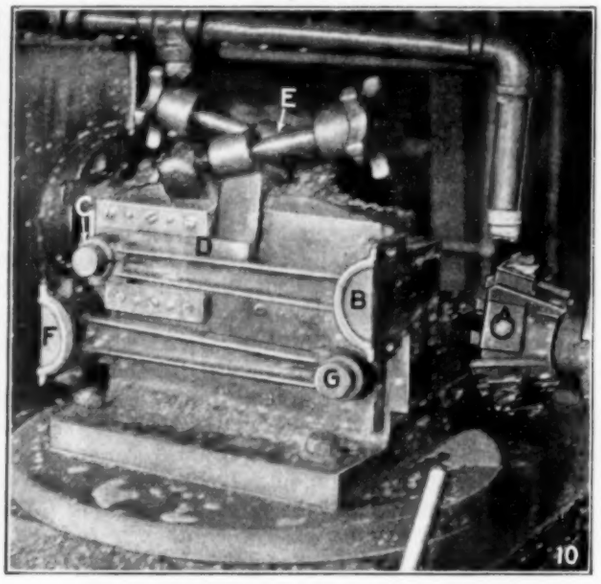

FIG. 10. FACE-MILLING END OF ROD

FIG. 11. PUTTING OIL SPLASHER INTO PLACE

The face of the cap is milled in a similar manner, and the rod and cap assembled with shims, bolts and nuts, the nuts being first run on with an air drill provided with a slipping clutch and finally tightened by hand. The crank end is then finish-reamed, filleted and a clearance broached on each side where the rod and cap meet. The splasher is then asesmbled in the cap as at *A* and *B*, Fig. 11, the rod being held in the fixture shown at *C*. The rod simply slips over the stud *D* and is held firmly in position by the latch *E*, while the splasher is being driven into place and the edge of the hole peened around it to prevent its becoming loose at some future time. The edges of the splasher are then trimmed on the grinding wheel shown at *F*. A final reaming, burring and washing makes the rod ready for final inspection before going to the assembling department. The rods are next assembled to pistons and carefully weighed to secure balance in the motor.

SEVEN CENTURIES of BRASS MAKING

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APPARENTLY the first attempt to cast brass in the North American colonies was made in 1644 by John Winthrop, Jr. in his iron foundry at Lynn, Mass. It is also known that brass cannon were cast in Philadelphia before the Revolution. Beginning in 1725 and for 50 years thereafter, Casper Wistar, his associate and successors, in Philadelphia, hammered out stills and kettles from brass and copper and cast some brass. (Bishop's History of American Manufacturers.)

In 1802, the Grilleys (Henry, Silas and Samuel), who had established a brass button business at Waterbury, Conn., in 1790, were joined by Abel and Levi Porter from Southington and began making buttons from sheet brass. This was the first known instance in America of brass making by direct fusion of copper and zinc according to the process invented by Adams Emerson in England in 1781. This undertaking also involved the first rolling of brass in this country.

II. The Crucible Process

The author tells of brass making by the crucible process, with its attendant difficulties. The field covered extends from the melting of the metal to pouring the molds. Also it is explained why the brass industry in America started in the Naugatuck Valley in Connecticut.

(Part I was published in the Oct. 21 issue.)

The American brass industry was imported from England in labor, processes, and machinery. Up to 1820 the American brass makers struggled along, engaged principally in making buttons which were sold by traveling peddlers. Competition with the English product was impossible until James Croft, an English brass maker, came to Waterbury, and hired out to the Scovill Manufacturing Co., where he introduced English machinery and processes. (Lathrop's "The Brass Industry in Connecticut.")

In 1830 Waterbury rolled brass became a factor on the American market and from then on the industry grew rapidly. Next came brazed tubing which was used for gas in New York City in 1836. Seamless tubing was the last important process to come from England, where it was invented in 1838. This process was imported by a group of Boston men in 1848, who organized the American Tube Works in 1850.

The first really basic improvement in brass working contributed by America was the invention of the spinning process in 1851 by Hayden. From this time on American brass makers forged ahead rapidly and soon took the lead over their English competitors.

The brass industry perhaps more than any other requires extraordinary skill that can only be obtained by long experience. Therefore, whenever a brass works started it was necessary to obtain one or more men skilled in the art, by taking them away from some works already in existence. The brass industry in America started in Waterbury, Conn., in the Naugatuck Valley. The reason for this is probably due to the fact that the people of Waterbury were largely engaged in the making of pewter buttons, which was an important home industry, and when brass buttons came into vogue these people were threatened with disaster. They were forced to take up the making of brass buttons in order to save themselves. Fortunately the natural conditions of Waterbury, such as water power for driving the machinery, water supply for washing the metal, and wood for annealing purposes, were favorable to brass manufacture, and therefore having started there, it continued to grow.

The fact remains that the industry did begin in the Naugatuck Valley and that this valley became famous as the home of the American brass makers. These men evidently liked the place where they were born as no one has ever succeeded in inducing any considerable number of them to go to another part of the country and this is undoubtedly the real reason why Connecticut has so long remained the greatest producer of brass in the United States.

The melting and casting of the metal in a brass mill is the most important step in the whole process of making brass materials, because any failure there cannot be rectified by later manipulation. However, in spite of the vital character of this stage of the process it is the one in which the least advancement has been made.

*Booklet published by the Bridgeport Brass Co., Bridgeport, Conn.

Practically all mills that produce brass for rolling into sheets or rods, or drawing into wire or tubes, employ the crucible in the coal-fired pit furnace, which is, basically, the same method as used in the middle ages. In Fig. 1, which was reproduced from a drawing made in 1672, it was seen that the three main elements of the ancient casting shop (furnace, crucible, and mold) bore a truly remarkable resemblance to the corresponding elements in the casting shop of some of the largest brass mills of today.

During the same period wonderful advances have been made by brass makers in the mechanical working of brass, so that it cannot be said that the practice of casting has remained stationary because brass makers have not tried to improve it. They have tried, and up to very recently it seemed as though it simply could not be done. The process was in the hands of skilled workmen, and each master caster guarded his secrets well.

In order to prove the statements just made with regard to the similarity of the ancient methods of brass casting and the modern ones, the operation of a modern pit furnace plant will now be briefly described.

The casting plant of the modern brass sheet, rod, wire and tube mill consists of the following main elements:

1—Furnaces. 2—Crucibles. 3—Molds.

Furnaces

The furnaces are almost without exception of the square, natural-draft pit type and usually employ anthracite coal for fuel. Fig. 12 shows a typical cross-section of such a furnace.

It should be noted that the principal difference between this furnace and the furnaces used in the middle ages is that the gases of combustion are carried off at the side, and lead to a chimney, while in the ancient furnaces they were allowed to pass up through the top and into the casting room. Then, too, the old furnaces were made large enough to hold a number of crucibles, usually eight (see Fig. 3), while nowadays there is one furnace for each crucible. The modern practice is to use anthracite coal in most instances although coke is also used quite extensively. In ancient times charcoal or wood was the fuel.

Crucibles

The crucibles, which are ordinarily made of clay and graphite, usually have a capacity of from 160 to 300 lb. of metal. They require great care in handling in order to obtain a satisfactory life, and for this reason and others they constitute one of the weakest elements in the casting shop. Ordinarily the life of a crucible is from 25 to 35 heats, depending upon the manner in which it is handled, and some casters, by virtue of special practices, get even longer life out of their crucibles. Comparing modern crucibles with those used in the middle ages, it is difficult to see any appreciable difference except the introduction of graphite, which has greatly increased their durability.

Molds

The modern mold is made of soft, gray iron, hand finished. Metal intended for sheet brass is cast in flat bars of varying widths, while metal for rods and wire is cast in cylindrical billets. Metal for tubes is cast either in solid or hollow cylindrical billets, depending upon the process employed. In ancient times stone was used for molds.

Casting in this type of plant is entirely up to the caster. He, with his one or more assistants, controls the fires, charges the crucibles, stirs and skims the metal, prepares and pours the molds. The whole process from start to finish is up to him, and he is usually paid on the basis of the output of good metal he attains.

The eight to twelve fires under the charge of one boss are all started at one time. The crucibles are warmed carefully before charging with scrap and copper ingot. If the crucibles are not carefully dried out and gradually brought up to heat, they will flake off and crack and their life will be materially shortened.

Charging

The charging of the crucible must also be made with care. For instance, if the crucible doesn't set firmly or evenly on the bottom, it will be subjected to undue strain and is even liable to tip over. Then, too, the charge itself must be so placed in the crucible that it will not become wedged and cause excessive strain against the sides when it expands before melting. All

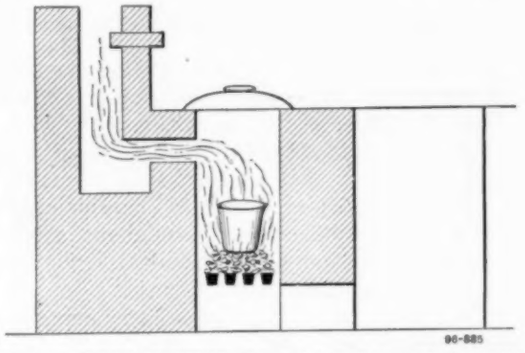

FIG. 12. CROSS-SECTION OF A TYPICAL PIT FURNACE

these points and many more require the constant and keen attention of the caster and his assistants.

As the copper begins to melt, a handful of salt is added and stirred in to remove the copper oxide, and then the surface of the metal is covered with a layer of charcoal to protect it from the action of the furnace gases or the air.

After the charge is completely melted and the temperature raised to the proper point, the zinc, or spelter is added. This temperature may be gaged by the expert caster by the color of the flame.

Adding Spelter

The spelter, being lighter than the copper, will float to the top and finally oxidize and waste away unless it is thoroughly stirred in and the surface protected with a layer of charcoal or some suitable flux. In Fig. 13 is a view of a modern casting shop showing a line of pit furnaces. The casters are stirring in the spelter. In the upper right-hand side of the photograph may be seen the hoisting apparatus that is used for lifting the crucible out of the furnace and manipulating it as will hereafter be described.

After the introduction of the spelter, the crucible must remain in the fire long enough to overcome the chilling effect produced by the introduction of the spelter, before pouring. If the crucible remains too long in the fire the metal will be overheated and an undue loss of zinc produced, while if it is poured too soon, before the temperature has attained its proper value, the casting will not be good.

The caster often judges the pouring temperature through the medium of his stirring rod. His sense of touch is so trained that he can perceive the vibration due to the boiling of the zinc, which signifies that it is time to pour.

Since all the fires are started at the same time, it naturally follows that all the various operations occur at approximately the same time. Consequently it requires extraordinary skill on the part of the caster to manipulate the fires in such a way that each crucible will be poured as nearly as possible at the time it is ready.

Skimming the Crucibles

The metal being considered ready for pouring, the coal is poked away from the crucible with an iron bar and the tongs, with which the crucible is manipulated, inserted and clamped. With a block and tackle, fastened to the light jib crane shown in Fig. 13, the helper hoists

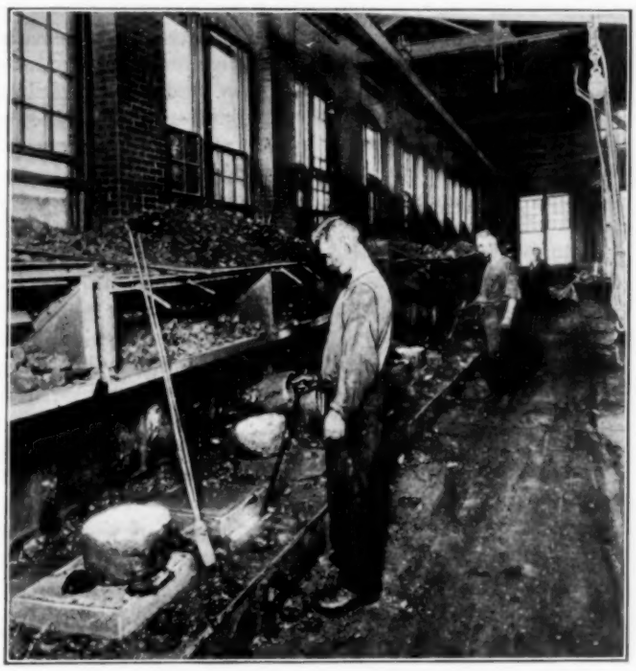

FIG. 13. A LINE OF PIT FURNACES IN A MODERN CASTING SHOP

the crucible out of the furnace and swings it to a position on the cast-iron floor as shown in Fig. 14, where the caster with a skimming iron removes the dross. This photograph is an excellent illustration of the volatilization of the zinc, which is going off in a white cloud because of the removal of the charcoal covering. Incidentally, this picture shows why casters often suffer from "spelter shakes" which is a mild form of poisoning supposed to be caused by the inhalation of zinc oxide fumes. This is one of the working conditions which makes the crucible process difficult.

The tongs, with which the crucible has been lifted from the furnace, are used by the caster to manipulate it during the entire operation of skimming and pouring. To keep the rope from too close contact with the heat and gases from the crucible, a link rod connects the block to the tongs. These tongs should be compared with those shown in Fig. 1, as there is practically no difference in the construction. The helper who manipulates the crane does so with the aid of a rope and a rod. The rope serves to hoist the crucible, while the rod, in

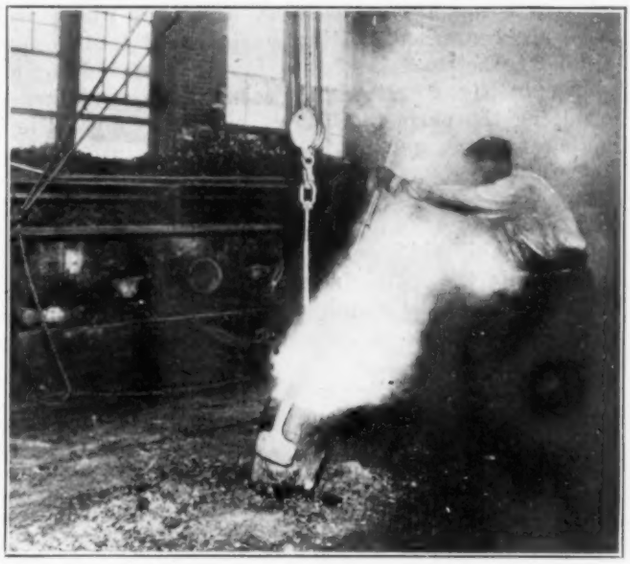

FIG. 14. SKIMMING A CRUCIBLE

addition to offsetting the side pull of the rope, enables the operator to push and pull the trolley and jib to any desired position, thus giving him complete control over the manipulation of the crucible. The caster has simply to tilt the crucible. This method of hoisting has been used for more than fifty years without appreciable change, although various unsuccessful attempts to replace it have been made. Its advantage is quick action.

Pouring the Crucible

As soon as the crucible is skimmed it is hoisted and swung into position for pouring as shown in Fig. 15. The pouring itself requires great skill, as the perfection of the casting depends to a very large extent upon the manner of pouring. As is seen in the illustrations, the caster rests the edge of the crucible on the mouth of the mold, and as he tips the crucible he holds back any dross or charcoal with a skimmer iron, and at the same time often uses the skimmer iron to divide the stream into two parts, in this way greatly improving the

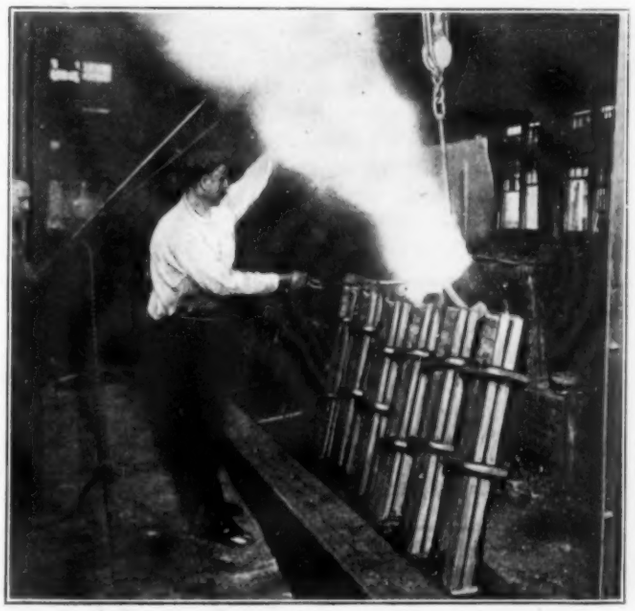

FIG. 15. POURING THE FIRST MOLD IN THE CRUCIBLE PROCESS

chances for a perfect casting, especially where wide bars are concerned. Attention is called to the great similarity between the molds here shown and the one shown in Fig. 2. It will be seen, that the method of clamping the parts together is practically the same in both cases.

Preparing the Molds

Previous to using, the molds are coated with a high-grade lard oil which serves a two-fold purpose, namely: it prevents the metal from acting upon the iron, and in burning at the mouth of the mold it envelops the stream in a reducing atmosphere which decreases the possibility of oxidation.

The molds are slightly inclined so as to make it easier for the caster to pour the metal, thus preventing it from striking against the sides of the mold. If the metal strikes continuously in one spot the casting will be porous on that side.

No attempt has been made here to cover the almost infinite number of fine points involved in the art of brass casting as practiced by the best men in the industry. In fact, the subject has never been reduced to an exact science and for the purpose of this article a more detailed description would be of little service.

Difficulties in Brass Making

The foregoing brief description of the routine operations in melting and casting brass, makes it perfectly plain that the human element enters into every step and detail of the process.

To keep ten fires right and take care of ten crucibles, putting in the spelter at the right moment, stirring and pouring at the right moment, is a full size job for the caster. There is a tendency among brass casters to use time as a guide in the execution of the various operations. However, this procedure cannot be relied upon for satisfactory results because of variations in the fuel, in the draft, in the weather, in the condition of the flue and in many other factors that may act to render any timing scheme for the various operations entirely unreliable.

In the last analysis it must be admitted that there is no positive way of determining just the right moment for carrying out the various important operations in the melting and casting of brass. It is simply a matter of experience, and even with experience as a guide, if the man hasn't the will and the power, he may not even do as well as he knows how. In other words, the character, disposition and moods of the men as well as their experience, enter into the making of brass by the crucible process.

The second undesirable feature of the crucible process is due to the extremely disagreeable working conditions imposed upon the men. Even with the best ventilation they are subjected to noxious fumes and extreme heat, and the more conscientiously they execute their tasks the worse the conditions they must endure. In Fig. 14 is shown a caster skimming a crucible with his head entirely enveloped in fumes. If he attempted to dodge the fumes, he would not be able to skim the metal as quickly and perhaps not as well, the result of which would be an inferior casting. To stand over the fires and stir the metal is an extremely hot and disagreeable job and yet the quality of the metal is dependent upon the thoroughness with which it is stirred. These are only instances which illustrate that the caster in the execution of his work must practically disregard the conditions under which it is done.

Composition Discrepancies

The crucible itself is often the cause of discrepancies in the quality of the metal, due to the fact that a slight leak has permitted a portion of the mixture to disappear into the furnace so that when spelter is added the ingredients of the brass will not be in the proportions expected. The proportions are also modified by various conditions which affect the volatilization of the zinc, so that, in spite of the most expert attention, the composition of brass made by the crucible process will vary and does vary more than most brass makers are willing to admit.

The composition is also affected by the furnace gases to which molten brass in a crucible is always exposed to a greater or less degree. In general, the action of these combustion gases is to change the chemical composition of the metal by oxidizing its ingredients and thus introducing impurities, as well as by removing a certain portion of the metal. The extent of the damage done by flue gases depends upon such factors as the temperature of the metal, the temperature of the gases, the composition of the gases, the velocity of the gases, the pressure of the air, and the perfection of the coating on the surface of the metal. Evidently, the combined result of these various factors is beyond human power to determine, except under test conditions such as may be obtained in a well-equipped laboratory.

Crucible Process Not Satisfactory

To sum up the crucible process of brass melting, it is sufficient to say that it is not susceptible to scientific control and therefore cannot be admitted as a satisfactory manufacturing process for the production of a uniform, high-grade product. Its possibilities are dependent entirely upon the individuals that operate it and the product can be controlled only by thorough inspection and conscientious scrapping of all metal that is below the standard.

Common Sense in Engineering*

By J. E. ALDRED
Founder of the J. E. Aldred Lectures on Engineering Practice

Common sense as a term is as old as the hills; nor is the definition of common sense obscure. The application of common sense, however, is always new to many. Each man who really grows, if he does not have knowledge of common sense thrust upon him, discovers it for himself. Let those who read benefit by the "thrust" here presented so that there will be less necessity to learn by experience.

ALLOW me to say at the outset that this article is not intended so much for students of pure science as for the average man who, having taken an engineering course, goes out to make good and earn a living. To that man I would say: "Try at the outset to get onto the firing line, that is, into the constructive work, whatever form it may take. Do not waste time around a city office, but get out onto the frontier, or into the shop, where you will learn to develop a practical turn of mind."

I am to say something about common sense in engineering. When we say "Common Sense," we mean the application of those fundamental elements of judgment which have, through usage, come under the homely term "Common Sense." It is more difficult to define than to illustrate. As applied to engineering, it may have no relation to engineering as such, but may be of great importance in the application of engineering to a problem. It is an element which is of importance in the training of students of engineering because, if kept constantly before them, it will, in the process of time, become instinctive in the practice of their profession. It is difficult to overestimate its importance, because it is something which may be passed on through an organization, and it may have a strong influence on the personnel of that organization. Later on I will give an illustration of this.

Accounts of Personal Experiences as Illustrations

It is my thought that I might best present to you what is in my mind if I attempted to take you with me through some of the personal experiences I have had in connection with engineering matters, beginning about twenty years ago, when I took up the first large project which brought me in close contact with engineers and engineering problems. This took the form of a development carried out by the Shawinigan Water & Power Co. in Canada. When I found that I was to take up this enterprise, I thought it well to see what work of this character was being carried out at Niagara Falls and elsewhere.

When I went to Niagara Falls and looked over the two large plants there—one having been built by the Niagara Power Co. and the other by a company under the name of The Niagara Falls Hydraulic Power & Manufacturing Co.—I was at once impressed by the difference between these two enterprises.

The plant of the Niagara Power Co. had been carried out by the engineers and designers with the design of making this a show plant; the beautiful power house was designed by no less celebrated architects than McKim, Mead & White. The grounds about the station looked almost like a park, and in the center of the plot, facing the power station, was a beautiful bronze flagstaff. The development indicated that an expensive upkeep would be necessary. The water was brought in from the river in a canal of comparatively small capacity, conveyed to the waterwheels which stood at the bottoms of deep pits which had been cut through the solid rock. The water, discharging from these wheels at something like 150 ft. below the surface of the earth, was carried under the city of Niagara Falls in a subterranean tunnel which served as a tailrace, and by means of which the water was discharged into the Niagara River below the Falls. Everything about this enterprise indicated a lavish expenditure and a disregard of economy.

The plant of the Niagara Falls Hydraulic Power & Manufacturing Co. showed, in every respect, the opposite inclination. The water was carried in a canal on the surface of the earth to the edge of a cliff, where it was taken from a collecting basin by means of penstocks over the side of the cliff and down to the bank of the river, where power houses were built. Here were installed the waterwheels and generators, and the water, after passing through the wheels, simply spilled into the river at the lower level.

Simplifying Problems

The impression made upon me as the result of examining these plants was that the engineer who had carried out the latter development had shown great economy and common sense in the general way in which he had met the requirements. I inquired as to who was responsible for the plant, and met Mr. Wallace Johnson, who had carried out the plans. The result of my visit was that when we were ready to go on with our work at Shawinigan Falls I called Mr. Johnson from Niagara Falls to take up the work in Canada; and that decision I never regretted. In all of the work carried out by Mr. Johnson there was constantly in evidence the desire to simplify problems and to apply sound reasoning and sense to the carrying out of every part of the work.

Now, to show how important this is—what a far-reaching influence a man may have on his associates. With Mr. Johnson there came to Canada from Niagara Falls two young men who quickly attracted my attention by reason of the fact that they, too, showed in their work an appreciation of the desirability of simplifying problems and applying to those problems calm and sane reasoning. It is enough to say that one of those men is now the head of the Engineering Department of the Pennsylvania Water & Power Co. and the other is the General Manager of the Shawinigan Water & Power Co. in Canada.

Mind you, I do not for a moment mean to convey the impression that these qualities which we designate

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as "Common Sense" and "Reason" will stand alone. They must necessarily be accompanied by technical training and the brain and ability, without which no man may rise to a dominating position in his profession. But the value of association of those men with that first man who was picked out among engineers as a man who more nearly answered the description of a safe and sane man, of sound judgment and common sense, has been of inestimable value to the men I have mentioned.

In speaking of the early work at Shawinigan, I cannot resist the temptation to recall an interesting incident which I associate, in my mind, with a man who accomplished wonderful things, involving pioneer work and engineering, and I attribute his remarkable success largely to the simplicity of his make-up and his great power of reducing complicated problems to their simpler elements. I refer to the late Lord Strathcona, who, in the early days of his work in Canada, was known under the name of Donald Smith.

Lord Strathcona—Donald Smith

When I had the work at Shawinigan Falls under way it was necessary to do some financing and sell some securities, and for this purpose I went to London. I was proposing a certain underwriting of securities and their offering on the English market, and among the men to whom I had letters was Lord Strathcona. He was then occupying the position of Lord High Commissioner for Canada to the Court of St. James, and was considered the foremost living Canadian. He was much interested in my story of what we were attempting to do by the development of power at Shawinigan Falls and its transmission through the Province of Quebec. After I had explained to him the general layout of the canal, penstocks and power houses, he said: "Mr. Aldred, tell me just where the first great penstock is to be carried down the hill?" I pointed out its exact position on the map and he said: "Is that not where the old portage was?" I answered: "Yes, and that was the only path we found at Shawinigan Falls when we first went there. We were in the forest." He looked up and said to me: "Mr. Aldred, many times have I traveled up over that portage with my tow-strap over my head, my canoe and pack on my back, on the way to the Hudson Bay Post at Kickindish, in the headwaters of the St. Maurice River."

Donald Smith, as he was then known, was the factor at a frontier post of the Hudson Bay Co., situated at the headwaters of the St. Maurice River. He spent ten years of his life there. Later on he spent twenty years of his life at a similar post in Labrador. This man came back to civilization from those frontier posts after having spent over forty years of his life on the outskirts of the Canadian settlements. And so strong was his faith and purpose that he was eventually the principal factor in the building of the Canadian Pacific Railway across the continent. His simplicity and sound common sense never failed him, and he accomplished perhaps as much in the way of engineering development as any man ever accomplished on this continent.

The development of the power at Shawinigan and its transmission to Montreal at high voltage represented one of the earliest works of this character. We had expected that by the time we completed our line a certain railroad bridge across the Ottawa River at the foot of the city of Montreal would have been completed, over which we had planned to carry our line. This project was delayed and it was necessary for us to find other means of crossing the river. Plans were made for high towers on either side of the river, and by the use of steel cables we were to jump over the intervening space, something like 5,000 feet. The most difficult element in the problem was to furnish strain insulators which would hold these cables at the point where we were required to take the current off for the transmission to Montreal. The carrying out of this work was of vital importance to the success of our enterprise. You will understand our feelings when, after successive tryouts of the strain insulators, we had to admit that they were a failure. It was put up to me that we would require to have new strain insulators, that it would take a considerable time to make them, to say nothing of the great expense. In fact, our whole enterprise was seriously affected by the failure. After giving the matter some consideration and throwing up my hands, I said: "Well, it will be necessary to find other ways of doing this. Why not support the crossarms on the cables, put pins and insulators on the crossarms and string ordinary transmission wires on these inulators and use the cables to carry the lines?" The engineer in charge of this particular work, a highly technical man, explained that the lines would not stand the wind strain and that they would not do this and they would not do that. I did not know exactly what a wind strain was, so he went on and told me all about a wind strain, and he also explained that for some six or seven other reasons this was an impossibility. In fact, he left me no conclusion except that I had better figure on a failure. However, we went on, and we did this crude thing, and the result was that we carried through the winter. We established our service in Montreal, and that crude method of getting over the difficulty was the thing that saved the day, and probably saved our company at that time. I only cite this case, not as a criterion, but as an instance of what happens sometimes when you have got to forget the extremely technical conception of things and do something to "get there."

Cedar Rapids Development

The next large development out in Canada with which I was associated was the development of Cedar Rapids, in the St. Lawrence River, and this furnishes a good example of how common sense and reason applies to a large undertaking. The Cedar Rapids development consisted of turning one section of the river bank into a huge canal which, skirting the rapids at this point in the river, gives at the lower end of the canal, under a head of about thirty feet, a large volume of water. When we came to the construction of this project we found it difficult to get contractors to make a reasonable bid for the work by reason of the fact that a good deal of the ground they would require to operate on was under water. After calling in some of the principal concerns in the country we decided that it would be advisable to carry out this work ourselves. We laid out the plans and plant, and uncovered the area, exposing the bed of the river, and after we had put the thing in shape so that everything was visible to the naked eye, we brought in a contracting firm in whom we had confidence to do the work.

It is enough to tell you that this method of carrying out this work resulted in a saving of over a million

dollars, as against the best price we had from any contracting concern. After we had worked on the Cedar Rapids for a year and a half, we saw signs of distress on the part of the contractors. They were working on the basis of so much a yard for earth, rock and concrete. They were good men and competent, and we went to them and asked them how they were getting on. And they finally confessed that it looked as if they would have two years' work for nothing. This was not a desirable situation. We had a year's work ahead of us to finish this plant and to put it in operation to meet the requirements of the city of Montreal. I said: "We will put an auditor on your books, and if your statement is correct we will make a new arrangement with you." We very quickly ascertained that they had told us the truth, so I worked out a proposition whereby they would be assured a profit of $150,000. We then said: "Now, go ahead with the work; keep the prices that you have been working under and see what you can do in the end. If you make any saving over and above the $150,000 that we are giving you as a profit we will divide it with you."

They worked up to such a degree of speed and efficiency—and they were employing between two and three thousand men—that during the next year it was perfectly wonderful to see the work go on. The net result was they not only saved the $150,000 that we agreed to give them as a profit, but they saved $75,000 additional, which we divided with them. In other words, the common-sense policy applied to this undertaking cost us not one cent, but it resulted in a saving to us and the contractors' making $187,500.

Development of Power on the Susquehanna River

I well remember when I first heard of the work which was to be carried on in the development of power on the Susquehanna River. A friend of mine told me of a visit he had made to the work and described the manner in which it was being carried on. He was familiar with the economical system we employed in our work in Canada, and he was setting up this Susquehanna River work as a sample of the opposite kind of management. After he had described the undertaking and the character of its plans for the carrying out of the work, I said: "Well, we may have an opportunity of taking it over some day." I little realized at the time the seriousness of that statement, but three years later I was appointed receiver for the company. I brought down and put in charge of completion of this work—the plant was about 50 per cent completed—one of the young men I previously referred to as having come to Canada with Mr. Johnson, and he carried out this huge undertaking—in sole charge of the engineering work—with the net result that the completed plant was at least 25 per cent better than it would have been in accordance with the original plans, and at a cost of something over a million dollars less than the amount which we had provided for him to do the work.

To illustrate how foolish engineers can be, I will tell you of one detail in connection with this plant on the Susquehanna River. We found, according to the original plans, that provision was made that the transformer house should stand on a bridge and that the cooling coils for the transformers should be submerged in the tail-race (this was a water saving device), under the arches of this bridge. Well, as you know, these cooling coils have hundreds of joints, anyone of which is liable to leak, and the only way to get at these cooling coils to make a repair was by putting on a diver's suit and going down under the bridge. The absurdity of such a scheme must be evident to anyone, yet this was a scheme devised by one of the well-known engineers in this country.

Now, a word as to the penalty for not applying reason and sense to engineering undertakings. In considering this, please keep in mind that a substantial percentage of the great engineering works undertaken are initial failures. I suppose you hardly realize that, but I know it to be true from a survey made of the principal engineering undertakings in this country and outside, and if it were necessary—but I think it would be inadvisable—I could give you a list of hundreds of huge engineering undertakings in this country that have been substantial failures.

Personally I have seen hundreds of reports on water power projects, but I have never yet seen an unfavorable report. To consider the seriousness of this, I will give you a specific instance of a company (which shall be nameless) which carried out a large water power development on this continent on the strength of a report by one of the three or four best-known engineering concerns in America. That enterprise involved an initial expenditure of over seven million dollars. The report set forth that the company could develop an initial 100,000 hp. capacity, and eventually could develop as much as 400,000 hp. capacity. The company has been in operation for ten years now and it has never, in any one year, developed 20,000 hp. capacity. What about it? Here is a report of a reputable (supposedly) well-known, engineering concern, on the strength of which report people made an investment of millions of dollars. Lost! And any man with sound common sense and any knowledge of the business could have said right at the start that it would be lost. What does it mean? It means that a lot of lads sitting in a drafting room down here in New York designed, subject to a report which they had from some of their superiors, I suppose, a plan to generate electricity by means of water power under conditions with which they were unfamiliar. They had only surface knowledge, but they wanted to do a job. Engineers always want to do a job of work. They never turn down a job; but what is the net result? The loss of millions of dollars in the course of a work that would do an indefinite amount of harm to other similar enterprises that may be suggested for years to come.

Profession of Engineering the Finest There Is

That illustrates the seriousness of engineering and practice without regard to sound reason and sense. I could duplicate the above case a number of times both in Canada and in the United States, but—what's the use? It does, however, bring home to you men this: That it is a very serious profession you are proposing to follow. I urge the necessity of bringing to bear upon the student of engineering the influences that will tend to make him more practical and constantly have in mind that an engineering project must check up, not only from the standpoint of the technical, but from the standpoint of the reasonable and the desirable, and that the student must cultivate this habit of considering his work from the standpoint of "Common Sense." Personally, I think the profession of engineering

is head and shoulders above every other profession. I am not an engineer; I wish I had been, it would have been the pride of my life. I think it is the finest profession there is. It gives a man a chance to get out onto the frontier, to get into the constructive side of things, and there is somthing about engineering that makes men. A man who follows the profession of engineering after a time gets into the habit of looking at the big things as of comparatively small importance, but big things to be overcome, and he goes to them and he overcomes the tremendous difficulties that are involved in all these great enterprises. It may be building a tunnel through the Rocky Mountains, in Canada or the United States. It may be some great reclamation project. What you like. But the carrying out of these enterprises and the training that a man gets makes, on the whole, by and large, a class of men that, to my mind, stand above any other class.

You men ought to be proud of your profession. You have before you, if you go through with this course, a chance to go out in the world and do your part. You have a living that should appeal to any man who has red blood in his veins. You can perform a useful function in society; you can do a work that will bear fruit after you have passed on.

Think of the work here at hand. Why, right here in the State of Pennsylvania the cost, by reason of the flood conditions of three great rivers in Pennsylvania, over a period of forty years, averages over $2,000,000 a year, and yet nothing has been done to curb these torrents. There's a job for some man—some one of you, perhaps. When he is doing it he not only saves the $2,000,000, but he will conserve for useful purposes the water resources of those rivers, and, by so doing, make it possible to produce hundreds of thousands of horsepower by the utilization of the Susquehanna, the Allegheny and the Monongahela Rivers. What better work could you have than that, and this is only a sample of the great things that are waiting for you men to do.

All I have to say in conclusion is: Go, see and do these things, and do them in a "Common Sense" way.

The Industrial Development of Australia

BY ERNEST L. LITTLE

THE remarkable industrial development of Australia is the result of accident rather than natural conditions. That country, with its enormous expanses of land suitable for farming, would doubtless have profited more if its population had become more largely engaged in the industries of the soil instead of engaging in manufacturing. The discovery of gold, however, attracted a population essentially industrial in character, and, coming in too great numbers, at the beginning of the second half of the last century, it failed in many cases to find employment or opportunity in connection with the development of milling. This surplus of labor showing a disinclination to offer itself for agricultural work, and remaining unemployed in the cities, created an acute problem for the government. With a view of remedying the situation, Victoria, and to a less extent, New South Wales, finally determined upon a policy of industrial encouragement and protection. By means of the tariff, bonuses, and bounties a great impetus was given to the local manufacturer of many articles that had previously been extensively imported.

Furthermore, the European war stimulated the development of Australian industries and everywhere there is evidence of increased industrial growth. Numerous factories and workshops are producing what has hitherto been imported. Some indication of the large scale on which certain industries are being established is given by the following figures published by the Commonwealth Treasury regarding issues of capital recently organized:

Nature of Industry	Capital Authorized
Extension of Steel Works	$7,917,795
Manufacture of paints, white lead	1,459,950
Manufacture of woolen yarn	681,310
Cement works	851,637
Manufacture of zinc	486,650
Manufacture of hosiery	437,985
Wool scouring	364,987
Manufacture of steel products	344,978

The general growth and the effect of the war on Australian industries is clearly indicated by the following figures, estimated in pounds, which show the direction of the industrial trend during the last ten years:

	1909	1918	Increase
	£	£	£
No. of establishments	13,229	15,421	2,192
Hands employed	266,661	328,049	61,388
Salaries and wages paid	21,111,656	38,379,268	17,267,612
Value of machinery, land and buildings	54,629,357	96,588,009	41,958,652
Value of materials used	64,028,881	146,181,866	82,152,985
Value added by manufacture	41,929,447	79,571,745	37,642,298
Value of output	105,958,328	225,753,611	119,795,283

Progress in Iron and Steel Products

During the last few years considerable progress has been made in the production of iron and steel products. Several large plants have been established and negotiations are proceeding, or in some cases completed, for the erection of works for producing galvanized iron, sheets, tin plates, fencing wire, wire ropes, and steel pipes. The State of Queensland possesses vast deposits of iron ore and coal, and the Government is considering the development of these deposits and the erection of a steel works, which will probably be located at Gladstone.

In the State of New South Wales are also found valuable resources for the extension of the iron and steel industry. A fine quality of coal is very abundant in the Blue Mountains, about one hundred miles from Sydney, and iron ore of about 58 per cent quality, together with limestone, can also be obtained in this district.

There has been considerable expansion in the manufacture of machinery of all kinds and while Australia cannot possibly compete in price with countries manufacturing machines on quantity production lines, the local demand will greatly aid the future development of Australian industries.

Manufacturing Industries—Value Added By Processes of Manufacture

	1915 £	1918 £
Treating raw materials, product of agricultural and pastoral, etc., pursuits	2,256,225	3,867,253
Treating oils and fats	795,721	1,366,219
Processes in stone, clay, glass, etc.	2,870,186	2,892,919
Working in wood	4,504,536	4,961,380
Metal works, machinery, etc.	15,067,974	17,090,920
Connected with food and drink, etc.	14,877,081	18,396,327
Clothing and textile fabrics, etc.	8,744,907	10,671,416
Books, paper, printing and engraving	4,790,263	5,740,863
Musical instruments, etc.	95,864	157,017
Arms and explosives	310,070	464,857
Vehicles and fittings, saddlery, harness, etc.	1,870,653	2,112,032
Ship and boat building and repairing	1,038,423	818,057
Furniture, bedding and upholstery	1,378,311	1,627,932
Drugs, chemicals and byproducts	1,416,617	1,958,153
Surgical and other scientific instruments	49,500	84,625
Jewelry, timepieces and plated ware	347,846	407,897
Heat, light and power	5,050,934	5,849,668
Leatherware, n.e.i.	231,207	293,230
Minor wares, n.e.i.	614,300	810,980
	66,310,618	79,571,745

Plants have been successfully established for the manufacture of brass and copper wire, tubes and sheets and also for the manufacture of brass and iron fittings of various kinds. The treatment and smelting of nonferrous ores of various kinds has developed rapidly and greater expansion is expected in this industry.

Despite the handicap imposed through inability to secure necessary machinery from England and the United States during the war, the woolen industry has made considerable headway. Several new wool spinning mills have been erected and others are in contemplation.

American hardware products are considered to be superior to those of British manufacture since the American packages are more adaptable for shelf display. These packages are said to be more clever in design and cheaper. Owing to the fact that it is possible to show the goods in suitable glass cases, thus enabling the customers to examine quickly a large array of articles, there is a greater demand for the American product. The customer is usually ignorant of the latest devices and the American method of display has especially appealed to the hardware trade.

While the population of Australia is very small in proportion to the enormous area of the country, the per capita purchasing power of the people is undoubtedly considerably above the average of most countries of the world. While the number of persons of great wealth in Australia is not large, the average means of most of the population is sufficient to allow purchase of the necessities of life, and also of a reasonable amount of luxuries. About a quarter of the population of the Commonwealth live in the two great cities of Sydney and Melbourne. The rural population is widely scattered. In many instances their holdings of land are very large, and probably the most prosperous people in the country are the "squatters," or holders of large estates, which are devoted chiefly to the pastoral industry, the returns from wool during the last few years having brought large profits to this class.

In a general way the articles required for the people of Australia are similar to those required in the United States, so that Australia naturally furnishes a suitable market for most of the products of the United States with the exception of agricultural products, most of which Australia produces quite sufficiently for her own needs.

In most classes of manufactured goods there is opportunity for extension of American trade if American manufacturers would give serious attention to this market and pursue the same enterprising business methods that they do at home. The American manufacturers who have established branches and have their own salesmen, have been doing a successful business despite the disadvantages of the high protective tariff.

For the sale of American machinery and hardware there should usually be a distributing agency or headquarters in the metropolis of each state, with a general headquarters at Melbourne or Sydney. As the population of Tasmania is small, and the island is reached over night by steamer from Melbourne, that territory may, in some instances, be easily covered from Melbourne.

The establishment of branch factories in Australia has been found a means of overcoming the protective tariff. Providing that unnecessary competition is not introduced, it may be said that branch factories of American manufacturers are welcome. Land is easily obtainable, but construction is costly, while skilled and unskilled labor is scare. Both classes of labor are inclined to be restive and to strike on the least provocation, but it should be noted that where welfare movements have been established comparatively few labor disputes have taken place.

When making shipments to Australia the details in regard to the usual size and weight of the packages containing any particular articles should be ascertained from the importer and these instructions should be carefully followed. The primary consideration of the American exporter must be safety of carriage. As all import duties are *ad valorem* and not levied on gross weight as is frequently the case in Latin-American countries, there is no reason for the manufacturer using too fragile a container for his goods in order to save weight and reduce the duties.

Care should be taken to make the packages as compact as possible as freight is generally charged on cubic measurement. A neglect of this precaution may lead to loss of business. As an illustration of this point, one of the reasons given why English enameled-iron bathtubs have enjoyed a greater sale than the American is that they are packed in crates containing four or five tubs, while the American crates contain only three. Thus, five tubs from England pay no more freight than three from the United States. In order to obtain this closer nesting the English tubs are made with sloping sides.

Special packing for animal-back transportation is not necessary in the case of goods shipped to Australia. The merchandise is discharged directly from the steamers to the docks and then taken to the warehouses by motor or horse-drawn trucks. If the goods have to be shipped back into the country, the transportation is by rail and breakage can only be avoided by the use of well made, strong cases, carefully secured. By taking these factors into consideration and following Australian methods of merchandising the American exporter can be assured of a constant growing market for his products in Australia.

Medical Aid Under the Compensation Acts

By CHESLA C. SHERLOCK

The attitude of the law toward the subject of medical aid for industrial workers is, in general, quite well defined. Who has the right to choose the physician to attend an injured man, the company or the employee himself? The subject of operations arising from industrial accidents is another point often misunderstood; the author covers such matters fully.

THE liability of the employer to furnish medical aid to injured workmen is absolutely fixed by the Workmen's Compensation Acts. There is no escape from it. This liability attaches even before the liability to pay compensation does.

It attaches even when there is no liability under the law for the payment of compensation, for many workmen are injured sufficiently to require medical treatment, but are not incapacitated from earning wages, within the meaning of the law. People receiving injuries of this class are not entitled to cash compensation from the employer, but they are, nevertheless, entitled to medical aid at his expense.

The liability for the payment of compensation and the liability for furnishing medical aid, while springing from the same root of liability in the law, are not in any sense to be considered as dependent on each other. Many employers feel, and rightly so, that unless they are liable for the payment of compensation arising out of an injury, they are not liable for medical treatment beyond first aid; but the converse of this is not likewise true, as many would suppose, that, unless they were liable for medical aid, they could not be held for compensation payments.

Medical Aid Must Be Provided

These things are not true, for the law provides, as the very first relief which the employer shall furnish an injured workman, medical aid. If the workman recovers rapidly and is back to work before the time fixed by statute for compensation begins, then such return to work relieves the employer of the necessity of paying compensation, but he is not relieved of the amount spent on medical aid furnished. On the other hand, the law feels that the workman has received sufficient compensation for the injuries received, if he gets back to work before the statutory "waiting period" has run, in the form of the medical treatment furnished by the employer; and it strikes a balance and calls the account square.

While it is not specifically provided in the various acts, it has come to be a part of the law by judicial interpretation, that the employer is liable for medical treatment, including first aid, at least, of all workmen injured in his employ, whether the workmen were injured under compensable circumstances or not. The employer cannot afford to take a chance and resort to snap judgment as to whether or not the workman was injured under compensable circumstances. He must assume that the workman was, for purposes of fulfilling the medical aid provision, and furnish first aid treatment, at least, without a question on his lips. Then, if investigation reveals the fact that the workman received his injury while outside the scope of his employment or through any of the means not recognized by the compensation acts, the employer, if he wishes to deny liability, may notify the workman and withdraw his medical aid.

The employer should ever keep in mind the fact that the injunction in the acts to furnish medical aid is not arbitrary, but in reality is a distinct advantage to him.

Competent Medical Aid Reduces Number of Serious Cases

Competent and adequate medical attention at the right time reduces the number of serious cases to a minimum and often prevents more serious complications that might impose a real liability upon the employer. I need only to mention a common fruitful source of industrial loss which springs from apparently trivial injuries, and, usually, from a lack of proper medical attention at the right time. I refer to blood poisoning. I have witnessed many severe cases of blood poisoning among workmen, and in practically every instance, the trouble came from a slight scratch or cut which the workman considered as inconsequential and which he did not have properly dressed by the company physician.

The liability to furnish medical treatment imposed by the compensation acts is placed upon the employer, not as an additional burden to be borne by him, or as an act of charity to the injured workman, but because it is legitmately a part of the cost of production, just as is compensation, and for the further reason that it is to the interest of the employer and of society to restore the workman to his normal usefulness at the earliest possible moment. This can be done only through the furnishing of proper medical aid promptly and without delay.

Choice of Physician Belongs to Employer

Naturally disputes arise as to the manner in which the medical aid shall be furnished. The law is not explicit; it does not go into detail. The employer provides a company physician and sends him when a workman is injured. The workman, on the other hand, is oftentimes suspicious of the company physician, thinks that he is working in the interest of the employer and does not trust him. He wants to call his own physician, in whom he probably has more confidence, and then he wants the employer to pay the bill.

Right here one can put his finger on the most fruitful source of trouble between employers and injured workmen under this section of the compensation acts. If the workman could be trusted to exercise that quality of judgment which the employer usually exercises (under state influence), then the courts might be more disposed to listen to the workman in his plea. Experience, however, has demonstrated that the workman cannot be trusted to secure the most competent medical aid when he is entrusted with that privilege. He is an easy prey to quacks and quackery. Too often he falls into the hands of a disreputable physician who has no desire to hasten his recovery as much as possible, but,

in order to fatten off the employer, merely cares to keep the patient on the road to slow recovery Then again, he may fall into the hands of some of the various faddists and cults who would experiment on him at the employer's expense.

The courts were at first undecided on this question, but they finally came to see that the only solution was to uphold rigidly the right of the employer to select the physician who was to treat the injured workman and to deny such right to the workman. The employer is the one who pays the bill. He is usually a man of affairs, and it is to his interests to get the workman back to his normal usefulness as soon as possible. Who, then, is more competent to select the physician? Because of these considerations, he is more likely to engage competent medical skill to treat the injured workman than the workman himself would be likely to do.

The employer, however, must post a list of the physicians he has designated to be called in case of emergency, and he must also give adequate instructions as to what must be done when it is necessary to make such a call. These instructions and this list must be posted in the place of work where the employees can have a chance to see them. In fact, the supreme court of Massachusetts has held that the mere posting of a list of physicians' names without instructions is not a compliance with the duty to furnish medical aid, and that an employee may call his own physician in such a case and bind his employer therefor.

Employer's Liability Limited

The law usually puts a time limit upon the employer's liability for medical aid, also a monetary limit. If the need for medical aid extends beyond these limitations, the employer is, of course, relieved of further liability and the injured workman must bear the additional expense necessary. Employers, however, do not hasten to absolve themselves of this medical liability, as a rule, if the workman is still in need of close attention. They realize that the better care he has the quicker he will recover from his disability and the sooner the payment of compensation will cease. Often the expenditure of a few dollars more for medical aid than that required by the statute will save many weeks' compensation payment by shortening the period of disability.

The payment of money for medical aid has nothing whatever to do with the payment of compensation. It is additional to such compensation payments as may be required, and cannot be deducted in whole or in part from the compensation due. Likewise, it is due whether compensation is due or not.

The Law Regarding Operations

When an operation is necessary to restore a workman to his earning power or former efficiency, it is the duty of the workman to submit, if such operation is of a nature not ordinarily dangerous to life. Refusal of the workman to submit to an operation may have a great effect upon the employer's liability under the acts.

If the operation or treatment which the workman refuses to submit to is a simple one, and such refusal greatly aggravates his condition and causes him to suffer a greater incapacity than he would have had he submitted at once, then the employer is justified in stopping compensation payment immediately.

The supreme court of Wisconsin tried just such a case and it ruled that the subsequent disability "is not proximately caused by the accident, but is the direct result of such unreasonable refusal." The court added that to prolong or increase the disability by such refusal, "and thereby place the burden of his wrongful act upon society in general, is not only repugnant to all principles of law, but abhorrent to that sense of justice common to all mankind."

This situation, however, is vastly different if the operation is a serious one and threatens the workman's life.

Law Does Not Require Any Man to Submit to Serious Operation

The law does not require any man to submit to an operation endangering his life, but he may do so of his own accord. If the workman refuses to have such an operation performed it is generally permissible to reduce his compensation payments to such amount as he would have received had the operation been performed and had it been successful. However, his payments cannot be cut off entirely unless all subsequent developments are clearly the result of his refusal and in no way the result of the original accident. If his life would have been saved beyond a reasonable doubt by a prompt decision to accept the operation, there is room for debate.

In Michigan such a case arose. The workman was urged to accept an operation immediately. He refused, but gave his consent the following day. The injury was to the intestines, but complications had set in and pneumonia resulted. As a result, the man died, and the employer claimed that he was not liable for the death, inasmuch as it had been caused by the refusal to submit to the operation when first offered. The court, however, took into consideration the fact that the workman was a foreigner and probably could not understand clearly what was meant, and held that it could not be said as a matter of law that his conduct was so unreasonable as to defeat the right of his dependents to compensation.

Rights of the Workman in Choosing a Physician

We have been assuming thus far in the discussion that the employer has promptly offered medical aid to the injured workman. But, where the employer fails to provide medical aid within a reasonable time after the injury a different situation arises. The workman then has the right to summon his own physician and he may bind the employer for the services so rendered, regardless of the fact that the employer did not select such physician.

The time during which the workman may bind his employer for medical services rendered by his own physician is from the time of the injury, or a reasonable time thereafter, until such further reasonable time in which the employer might have furnished his own physician. If the employer supplies medical aid within any period of his disability, the workman must ordinarily dismiss his own physician and accept the employer's, except in a case where a capital operation is necessary, in which instance the original physician will be retained throughout the case, unless it be shown that he is incompetent.

It is generally held, in the case of an emergency, that if a physician other than the employer's designated physician is called, whether by request of the injured

workman or by his fellows, the employer will be bound for the services rendered by such physician. It is generally held that the physician most quickly obtainable must be summoned whether or not he be known to the employer or workman, and the employer can later turn the case over to the company physician, if he was not summoned in the first instance.

The employer must furnish the medical aid immediately and he must offer it whether the injured workman requests it or not. Employers are not relieved from the obligation by saying that the workman went home and did not ask for medical aid. The notice of injury of a workman to the employer is also notice to such employer to furnish such workman with competent medical aid. If the employer does not furnish it, within a reasonable time after the injury, and has said nothing about it, the workman has a right to call his own physician and charge the bill to the employer.

Competence of Employer's Physician

It will be noticed that the employer must furnish "competent" medical aid, and when he fails to do this he has, in the ruling of the courts, furnished no aid at all and the workman will be justified in procuring his own physician. In Connecticut it has been held that the employer did not furnish competent medical aid when he furnished a chiropractor. Said the commissioner:

"The notion of competency, when embodied in a legislative act, connotes conformity to some prevailing standard. . . . There are numerous schools and cults enjoying limited patronage and making divers claims of ability to alleviate pain and cure disease, whose merits it is not necessary for me to consider. . . . When the employer, operating under this statute, undertakes to provide an exponent of any such school or cult as 'competent,' and the question of competency has to be passed upon by the commissioner, the measure of competency then becomes the prevailing standard of society, not the judgments or convictions of the employer, however sincerely or disinterestedly exercised. . . . While it is not without the limits of possibility that some person or persons, either by reasoning on theoretical grounds or by experimentation, or even accident, might discover a new and better method than that generally practiced and taught, such a contingency is highly improbable and the employer who under this act provides a practitioner of any such unusual method, contrary to the prevailing standards of society and the consent of the injured employee, fails to conform to the provisions of . . . the act."

Changing of Physicians

It seems well settled that the time for the employer to bring his own physician into the case, where he was not summoned in the first instance for the emergency treatment, due to a failure to provide or an inability to procure, is at the end of the emergency treatment immediately following the injury. Employers must take into consideration the ethics of the profession as well as the rights of the injured workman. They cannot unnecessarily embarrass him or his chances of recovery by changing physicians in the middle of a necessary treatment or period of treatment, especially when the need for any such change at all rests upon their original failure to provide.

If the employer fails to furnish a physician within a reasonable time, he cannot compel the injured workman to discharge his physician and accept the treatment of the employer's physician whenever the employer gets ready to furnish such treatment. The employer's right to designate the physician does not extend this far by any means. In a California case it was said that the employer must take the initiative and that he must act promptly, else he will lose his rights and cannot thereafter require the workman to change his physician.

Amount of Expense for Medical Aid

The employer is liable for the reasonable value of all necessary medical services which grew out of the accidental injury. This has been held to include hospital treatment, first aid, dental work, and the further necessary treatments during the time limit specified in the statute, but within the maximum money amount allowed. It does not, however, include treatments rendered by unrecognized cults or schools, such as chiropractors or Christian Science healers.

In Connecticut it was held: "The amount to be charged by the physician is not to be determined by what the insurance company or the industrial corporation is able to pay. It is not to be determined by the physician's estimation of the disposition and social qualities of the insurance adjuster or attorney. It is not to be determined by what the particular physician, whose bill is being considered, has been in the habit of charging and collecting in like cases. A physician who is treating a compensation case is supposed to charge and collect from the employer or the employer's insurer as much, and only as much, as the profession in general in his locality would ordinarily charge and collect from a workman of like standard of living if he was injured at home and had to pay his own doctor's bill."

How to Appeal When a Physician Overcharges

If the employer feels that the physician has charged him too much for the service rendered, he has a right to appeal to the Industrial Commissioner or Commission for an audit of the bill. Usually all that is necessary is to forward the bill to the authorities with a statement of the nature of the treatment rendered.

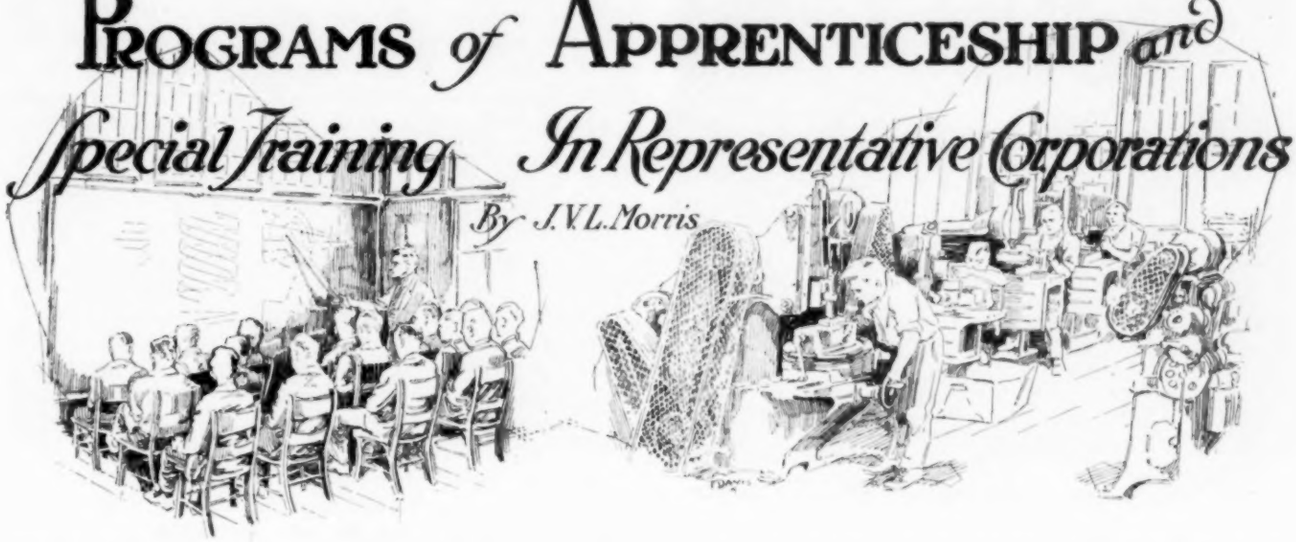
The bill must be itemized. The employer is not liable for the maximum statutory charge allowed in each case, but merely for the reasonable value of the services rendered, not exceeding said amount.

The Iowa Industrial Commissioner has said: "When submitted for judgment, it is the statutory duty of the Industrial Commissioner to pass upon bills for legal services and medical and surgical relief afforded claimants. . . . Physicians should submit bills no larger than in case the same were to be charged against the workman himself. The idea, where it may obtain, that low fees are simply a benefit to a rich insurer should be abandoned, since he is able in the long run to take care of himself by an advance in rates and the excessive charge is simply a tax on consumption and society in general."

In closing the discussion, it is necessary only to call attention to the fact that if nursing is necessary it may be considered a proper charge to list under "medical aid." This will be determined upon the same test for reasonableness as other medical charges are. The employee or members of his family, however, are not entitled to recover the value of their services while attending the injured workman at home, nor to charge the same to nursing expense when no hospital care or attention is necessary.

Programs of Apprenticeship and Special Training In Representative Corporations

By J. V. L. Morris



THE Westinghouse Co. is one of the great manufacturing concerns of the world. In the East Pittsburgh works alone eighteen to twenty thousand people are employed. Under the heading "Some Westinghouse Products," published by the company, are mentioned such articles as automobile starting and lighting systems, circuit breakers, condensers, fuses, gas engines, generators, heating devices, lightning arresters, electric lamps, locomotives, meters, ranges, rectifiers, rotary converters, transformers, and steam turbines. While this is only a partial list, a glance will show that not alone skill but an immense amount of initiative and experimentation is necessary for developing and improving not only the products but also their means of production. An organization consisting of designing and organizing engineers with a supply of labor of specialized efficiency is not alone sufficient. To these two important groups there needs to be added the third type of workman, not with the highly technical training requisite in the engineer, but equipped with the practical all-around shop knowledge that will enable the attacking of problems of machine operation and control with some probability of obtaining a solution. This third type, the mechanic, must be given recognition in the company's organization.

IV. The Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

In this article the methods employed for training apprentices and machine men in the electrical industry are again taken up. The various factors, such as selection, education, grading and promotion, which enter into the conducting of an apprenticeship program are all considered, as well as Americanization and the training of graduate engineers.

(*Part III was published on Oct. 21*)

An examination of the educational department of the Westinghouse Co. shows that these three primary differentiations of productive skill and intelligence are recognized by the management. Special training and various devices of expert employment management are practiced to produce optimum efficiency among the partially skilled and specialist labor groups. Carefully supervised apprenticeship and a flourishing technical night school provide the training and industrial education for the skilled or mechanics group. Finally, being one of the leaders among manufacturing concerns and requiring a large technical staff, some three hundred or more graduates of the leading engineering schools are each year taken in under conditions approximating apprenticeship in order to recruit the engineering and administrative force of the company.

Special Training

Considering these various programs more in detail we find that to efficiently handle the unskilled and partially skilled labor employed, an elaborate system of employment management is utilized. To facilitate this job-analysis cards have been prepared enumerating in detail the duties of each separate occupation in the plant, and a number is affixed to each occupation by which foremen can make requisitions on the employment department for additional workers. Standard methods are used to reduce labor turnover, one of them being transfer, which is employed when work slackens in one department and increases in another or when dissatisfaction develops between a foreman and one of his workmen. Before any employee is discharged or withdrawn of his own accord the department endeavors to arrange an interview to discover the real reason and, if possible, to adjust the matter amicably.

At the present time an intensive training course is being conducted for stenographers. The students are already either experienced or fresh from the commercial schools, and they are given this special training primarily to acquaint them with company forms and practices, as well as to give them acquaintance with technical terms peculiar to the industry. The course lasts from a period of a few days up to several weeks, according to the ability of the pupils enrolled and the demands made for stenographic help in the various departments.

Similarly, recruits to the clerical force are provided with special training by the educational department upon requisition from the department by which they are employed. This may take the form of four hours per

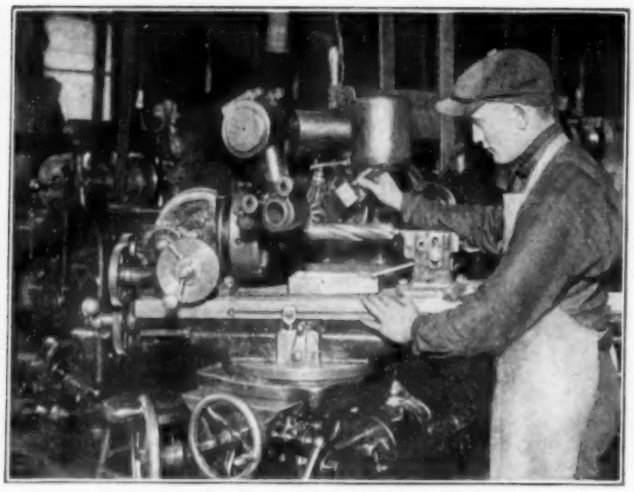


FIG. 16. APPRENTICE OPERATING A MILLING MACHINE IN THE TOOLROOM

week of instruction in matters directly related to the work, and is provided for both sexes.

Of greater interest from a mechanical standpoint is the special training department or "vestibule school" for operator-specialists on the various machines. A boy or young man wholly inexperienced may in a few days to several weeks be taught to operate a boring mill, lathe, or milling machine, and thus in a very short time reach the standard production-capacity when he is transferred to regular production work. A small department, segregated from the usual production floors and containing standard equipment, is provided for this purpose. None of the work is, however, of an exercise sort, but of a kind suited to beginners chosen from regular production jobs. A similar training department is provided in winding and taping for female employees.

APPRENTICESHIPS

Concerning the organized apprenticeship and evening instruction provided for the mechanics or skilled craftsmen, we shall consider first apprenticeship, which has not waned in popularity either with the more capable boys, or with the plant's administration, despite the existence of the intensive machine-training just described. This is due to the facts that a broader training is provided and steadier qualities are proved by the willingness to forego standard production wages during a long period of training. A group of superior workmen is developed, who are assured of steady employment and later of preferment in the choice of foremen, superintendents and ultimately even of executives. There is no break in the ladder of advancement to the boys who will take the all-around training.

We find at the present time 198 four-year apprentices employed in the East Pittsburgh works. These are divided as follows: 142, or 72 per cent, are in the machinists' and toolmakers' trades; seventeen, or 9 per cent, in the patternmakers' and thirty-nine, or 19 per cent, in the electricians' trade. There is, in addition, an opportunity offered for apprenticeship in patternmaking and foundry work in the Cleveland plant of the company, where ten apprentices are enrolled.

An effort was made to discover the ratio of apprentices to skilled men in the various trades, but without success, owing to the lack of a definition as to what constitutes a skilled man. For instance, thirty-nine electrical apprentices would, of course, be a very insignificant number compared with the very large number of people employed on electrical work in the plant, and the same applies, though perhaps in less degree, to the other trades. One must recognize that in this plant, as in most large manufacturing concerns, much of the training, if provided at all, is in limited special fields and does not conform to regular apprenticeship. "The latter is designed to produce a man with far broader knowledge than is generally required on the majority of production jobs."

INSTRUCTION OF APPRENTICES

Approximately one-third of the 4-year course is spent in a special training section by the machinists and toolmakers and the remaining two-thirds in various sections of the works which provide facilities for broad experience. Fig. 16 shows an apprentice operating a milling machine on a job requiring considerable skill. There are, however, no special training sections for patternmakers or electricians, as in those trades it is believed advisable for the apprentices to learn their trades by working with journeymen in the respective shops. Fig. 17 shows an apprentice at work on a pattern, while in Fig. 18 another can be seen wiring a switchboard. Definite schedules for transferring apprentices from one kind of work to another are administered by the educational department, in order to insure that each apprentice receives an all-around and balanced training during his course.

For all apprentices four hours per week during the entire course is given up to classroom instruction. Classes meet from 7 to 9 a.m. in the educational department for the study of mechanical drawing and practical shop problems. The textbooks for these courses have been compiled by the instructing staff, all problems used being those actually met in the shops.

The instruction in mechanical drawing includes blueprint reading, sketching, layout problems, developments and tool design, Fig. 19 showing apprentices at work in the drawing room. In the course in shop problems instruction is given by means of problems in English, mechanics, shop system, costs, and the application of the principles of arithmetic, algebra, geometry, and trigonometry to shop work. Fig. 20 shows apprentices at work in the shop problem class.

Two hours' home work is required each week in addition to class work. Instructors in the apprentice

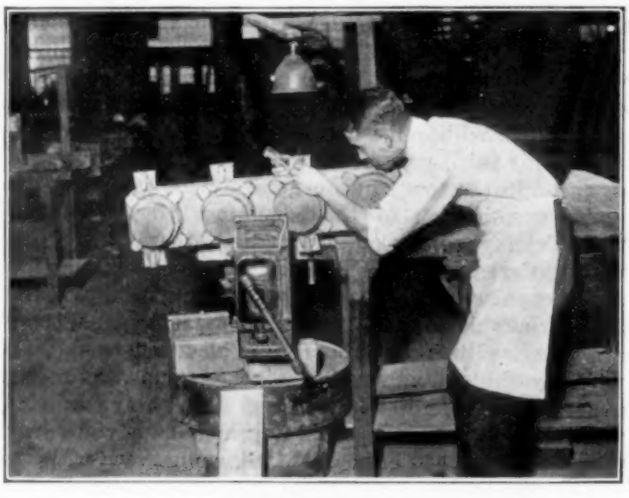


FIG. 17. APPRENTICE MAKING A PATTERN

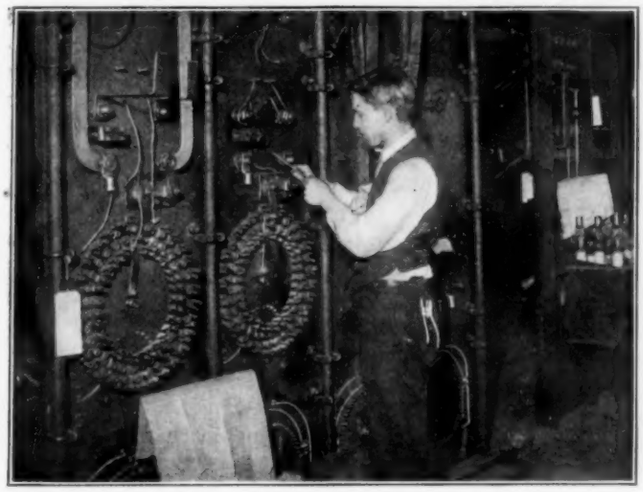


FIG. 18. ELECTRICIAN APPRENTICE WIRING A SWITCHBOARD

school are selected from the engineering, drafting, and shop departments of the company. Because of their close contact with the shop conditions encountered in this particular industry these men are obviously particularly well qualified to develop in each apprentice a correct understanding of the work involved and an appreciation of the relation between the various trades and the industry as a whole.

As the method of training is similar, mention should here be made of the opportunities offered to those who wish to become draftsmen. They start as tracers in the drafting department, and are given a 2-year supplementary course for six hours each week by the educational department. This instruction covers design problems involving various applications of mathematics, physics, mechanics, materials, shop methods, estimating and cost calculating in tool design. It also includes such special subjects as lubrication and bearings, heat transfer and ventilation and electrical machinery. The pay is somewhat better than for trade apprentices.

Wages of Apprentices

The pay of apprentices as in other progressive corporations, has shown considerable appreciation, both during and since the conclusion of the late war. On Jan. 1, 1920, the schedule stood as follows:

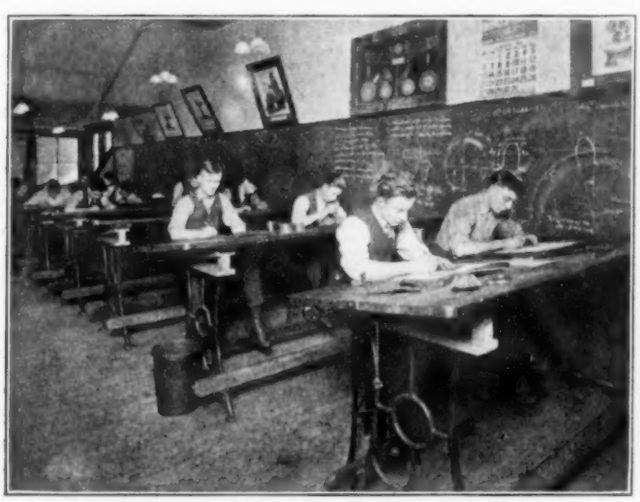


FIG. 19. APPRENTICES IN A MECHANICAL DRAWING CLASS

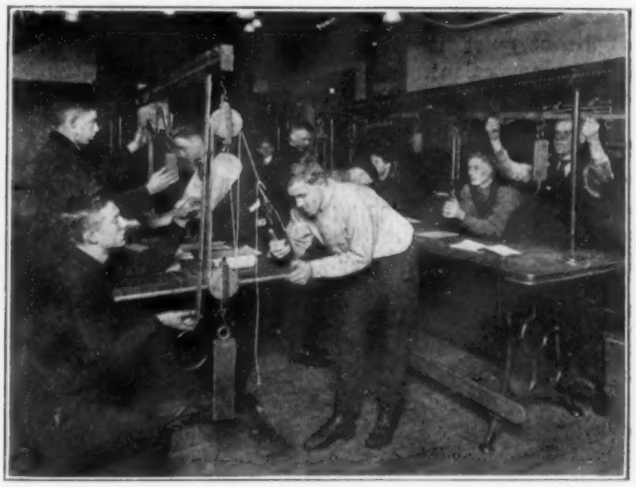


FIG. 20. CLASS OF APPRENTICES STUDYING SHOP PROBLEMS

22c.	per hour for the first	1,218 hours
24c.	per hour for the second	1,218 hours
26c.	per hour for the third	1,218 hours
28c.	per hour for the fourth	1,218 hours
31c.	per hour for the fifth	1,218 hours
35c.	per hour for the sixth	1,218 hours
39c.	per hour for the seventh	1,218 hours
44c.	per hour for the eighth	1,218 hours

This pay is based on a 48-hour week, or an average month of 203 hours. A period of six months is thus 1,218 hours.

The Selection of Apprentices

The company takes much care in the selection of apprentices. For admission to the trade courses the applicant is required to be between sixteen and nineteen years of age and possess the knowledge of English and arithmetic to be expected of a grammar school

WEIGHT CHART FOR SELECTION OF TRADES APPRENTICES

MENTAL	WEIGHT		
(a) Two-year high school at 16	5	( )	
(b) Observation	5	( )	
(c) General knowledge	5	( )	
(d) Attitude	5	( )	
(e) Self reliance	5	( )	
Total	25		( )
MORAL			
(a) Manners and habits	5	( )	
(b) Character	10	( )	
Total	15		( )
PHYSICAL			
(a) Appearance	5	( )	
(b) Activity	5	( )	
(c) Health	10	( )	
Total	20		( )
GENERAL IMPRESSION			
(a) Tact	5	( )	
(b) Common sense	10	( )	
(c) Mechanical aptitude	5	( )	
(d) Future ambitions	5	( )	
Total	25		( )
MATHEMATICS	10	( )	
REFERENCE	5	( )	
Total	15		( )
GRAND TOTAL	100%		( )

APPLICANT..... DATE.....

COURSE..... INTERVIEWER.....

ACCEPTED..... 1. COMM. CHECK.....

REPORTED..... 2. COMM. CHECK.....

3. COMM. CHECK.....

AGREEMENT SIGNED.....

FIG. 21. THE WEIGHT CHART USED BY THE COMMITTEE

graduate. For the electrician's course, in addition, the applicant must have two years of high school training or its equivalent. Complete high-school training is ordinarily required for entrance to the drafting course.

Every applicant is interviewed by two or more members of the company's trades apprentice committee, usually the director of trades apprentice instruction and one of the foremen being included. In case of doubt or disagreement as to the suitability of a candidate he is turned over to one or two additional interviewers, whose judgment is final as to acceptance or rejection.

Fig. 21 shows the chart used by the interviewers while judging the important characteristics of the applicant. Re-ratings by the committee are made at the end of each of the first three months of probation period, the entry being made in the space at the lower right hand corner of the form. If at this time an applicant is rejected for apprenticeship, the practice is to find other work for him in the plant for which he is more suited. The educational department is equally painstaking in its records of the boy's progress in both his studies and shopwork, entering the amount of time spent in each of the distinct units which together form the complete course.

An interesting method has been developed for rewarding extra proficiency. "Once a week the committee comes together, and at each meeting the records of all apprentices who have finished eleven months of the apprentice year are brought to the attention of the members. The committee examines the records and grades the apprentices into four classes, A, B, C, and D. If an apprentice is placed in Class A, one month is taken from his apprentice course, or in other words, he is permitted to begin immediately on his next year. If an apprentice should be graded as a Class A man at the end of each eleven months during the 4-year apprenticeship, he would save one month each year and would finish his apprentice course four months ahead of schedule. If he finishes his course as a Class A man he will also be accorded a higher rate as journeyman than he would if he finishes as a Class B or Class C man. At the present time, the rate per hour for Class A men is 3 cents higher than the rate for Class B men, and the rate for Class C men, 3 cents lower than the rate for Class B men. If the apprentice is placed in Class B, he will be required to serve his normal time. This class includes the majority of the apprentices. If he is placed in Class C, he is notified that he must show an improvement, and if he should be so deficient that he is placed in Class D, he is either discharged or sent to the employment department for suitable work." During 1919 thirty-seven were given Grade A rating among the trades apprentices and student draftsmen.

The Technical Night School

The night school, which has been previously mentioned, operated under the name of the "Casino Technical Night School." It is independent of the company in its corporate organization, though something over one-third of its revenue is provided by the company. Nearly half of its income, however, comes from fees of the students. The course in fundamental engineering principles costs $16.50 for each of the two terms per year, the same fee being charged in the preparatory department, while in the foreign department the charge is $7.50 per term, and in the women's department $12.50 per term. The imposition of so considerable a fee naturally limits the attendance to the more serious students. Consequently, the classes show a much better record for remaining through the course than is the experience of most night schools, the curve shown in Fig. 22 giving the results of a recent term.

The enrollment is ordinarily less during the second term than in the first; but on March 1, 1920, it was as follows:

Engineering department	372
Women's department	169
Peparatory department	61
Foreign department	25
Total	627

The school, as its attractive announcement states, was founded in 1902. It is located in the several public schools maintained by the communities in the neighborhood of the Westinghouse industries, where the population is of course largely employed. However, admission is extended to all, regardless of occupation, previous education, or present place of employment. Only those who have completed their elementary education are

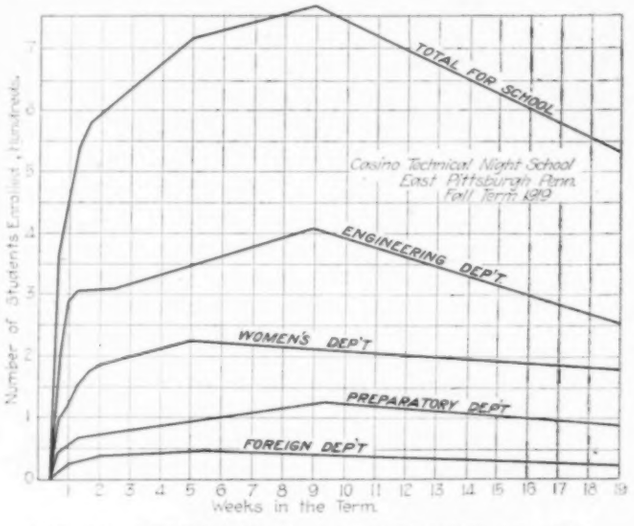

TOTAL FOR SCHOOL
Casino Technical Night School
East Pittsburgh Penn.
Fall Term 1919
ENGINEERING DEP'T
WOMEN'S DEP'T
PREPARATORY DEP'T
FOREIGN DEP'T
Number of Students Enrolled, Hundreds
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Weeks in the Term

FIG. 22. CURVE SHOWING ATTENDANCE AT HIGH SCHOOL CLASSES

allowed to enter the engineering course. All others must enter either the preparatory or foreign departments. An interesting feature worth considering for our public schools is that, in addition to grading on regular courses, all students receive ratings on the personal characteristics of judgment, thoroughness, personality, reliability, initiative, and health. These ratings are not shown on the report cards which are sent to the students, but are retained on the permanent record card in the school office, where they may be consulted by the students and may be utilized in considering promotions. A faculty of approximately sixty-five, mostly technical graduates drawn from the staffs of the company, together with the able administration, assures a high quality of instruction.

The standard weekly schedule of the engineering course, from which no variation is ordinarily permitted, is shown in Fig. 23. Inspection trips to a dozen nearby industrial plants form a useful supplement to the regular instruction, and an hour assembly is held every other week. At these assemblies talks are given by members of the board of directors, by some of the older engineers, or by prominent men. It may also be mentioned that graduates are permitted to make application and to

enter, if accepted, the one-year course for technical engineering graduates. Several are at the present time availing themselves of this privilege.

That the school has been successful is shown by the positions held at present by the graduates of the course up to and including the class of 1919. A summary of the positions follow:

Administrative	27	Commercial	38
Managers 8		Business 2	
Superintendents 5		Oil field development 2	
General foremen 2		Salesmen 24	
Foremen 12		Clerks 8	
Engineering	72	Advertising writer 1	
Operating and service engineers 24		Buyer 1	
Design and research engineers 18		Manufacturing trades	10
Consulting engineers 1		Machinists 7	
Supervisor 1		Skilled workmen 9	
Draftsmen 10		Miscellaneous	7
Tool designers 3		Farmers 3	
Teachers 2		Students 3	
Inspectors 7		Lawyer 1	
Testers 6		United States Army and Navy	29
		Deceased	6
		Unknown	2
		Total	197

This is a particularly satisfactory record when it is considered that the average period since graduation is only approximately six years. It should also be borne in mind that the school has been of benefit to industry in general, since one-half of its graduates are now in the employ of companies other than the Westinghouse.

ENGINEERING DEPARTMENT

STANDARD WEEKLY SCHEDULE

Days per week	MONDAY			WEDNESDAY			FRIDAY		
Hours when classes begin	5.45 p.m.	6.45 p.m.	7.45 p.m.	5.45 p.m.	6.45 p.m.	7.45 p.m.	5.45 p.m.	6.45 p.m.	7.45 p.m.
FRESHMAN YEAR									
1st Term	Shop Problems	Foundry		Shop Problems	Pattern Shop		Shop Problems	Mechanical Dwing	
2nd Term	Algebra	Mechanical Drawing		Algebra	Mechanical Drawing		Algebra	Mechanical Drawing	
SOPHOMORE YEAR									
1st Term	Algebra	Machine Shop		Algebra	Machine Shop		Algebra	Machine Shop	
2nd Term	Physics		Geometry and Trigonometry	Physics		Geometry and Trigonometry	Physics		Geometry and Trigonometry
JUNIOR YEAR									
1st Term	Physics			Electricity	Mechanics	Business English	Electricity	Mechanics	Business English
2nd Term	Electrical Laboratory			Chemistry	Electricity	Mechanics	Chemistry	Electricity	Mechanics
SENIOR YEAR									
1st Term	Steam	Engineering Problems	Electricity	Electrical Laboratory			Engineering Problems	Steam	Electricity
2nd Term	Engineering Problems	Steam Laboratory		Engineering Problems	Metallurgy		Electrical Laboratory		

Students will be notified of assembly in auditorium.
This schedule is subject to change at the discretion of the faculty.

FIG. 23. SCHEDULE OF CLASSES AT THE NIGHT HIGH SCHOOL

Americanization

The company under consideration is one of the few among those investigated which had already awakened to the desirability of Americanizing its alien labor before the dis-affection and unrest attendant upon the late war aroused the country to action. From the very beginning of the technical night school a course in English and civic education for the immigrant employees has been in operation. Many have been taught English and encouraged to become citizens. There are twenty-five enrolled in this course at present, receiving instruction for three hours per night on three evenings per week. There are also provided free evening classes twice a week in sections of the plant employing a considerable number of foreign laborers. In these classes 110 are enrolled and seven paid teachers are provided. While the more extensive course in the night school provides an opportunity for the ambitious young men, these latter classes appeal more particularly to the older men and between the two methods practically all non-English-speaking employees are reached.

The aims of the classes might form a suitable program in any plant:

1. Learn to speak, read and write English.
2. Learn about the United States Government and how to become a citizen.
3. Learn how to figure your pay by the different methods used in the works.
4. Learn how a big company like this is built up; where the money comes from to build it and pay wages.
5. Learn how to help yourself by being of service to other people and working well with them.

The success of the program may be gaged by the fact that during the past year 114 men were assisted in obtaining first papers and 153 their second papers. The secretary of the Americanization committee aids the men in every way and pays for the time of witnesses.

Graduate Engineers' Apprenticeship

To recruit the engineering and administrative staffs graduates of the leading engineering schools are taken into the works for a year of training on a basis similar to that of internship for medical students. The number varies somewhat with the needs of the plant from year to year, but three hundred seems to be about the average number received. These students spend several months in the shop acquiring experience and information regarding the company's products, personnel, and policy; and they are then segregated into the specific branches which they expect to follow as their respective vocations. There are three fundamental lines of employment open to them, namely, design engineering, works management and sales. Approximately 40 per cent go into engineering, 40 per cent to sales, and 20 per cent to works management. Special schools are provided for the design engineers and sales students. These schools run for twelve weeks usually, during which time the student receives his pay but does no productive work. At the present time the pay is $90 per month for the first six months and $95 for the second six months.

The Organization for Education

Every one recognizes that the primary purpose of a manufacturing corporation is to get production. It is a newer conception that there may be an important secondary purpose in education, which may, moreover, minister profitably to the main object of producing goods. The staff used to effect this secondary aim needs to be as efficiently organized as for production. In the case of the company considered, the educational department has at its head a manager with a considerable staff. For the graduate students and for the trades apprentices there is in each case a director, and for the two departments, a foreman in charge of schedules. Competent individuals from each field are detailed to handle tracing and drafting instruction and clerical and stenographic training, while the director of trades apprentice instruction supervises the English and

Americanization work. The Casino Technical Night School has as president the manager of the educational department and as manager a man devoting his whole attention to it and to the somewhat closely related welfare work of providing noon lectures and directing the Valley Garden Association, which provides an opportunity for employees who wish to raise vegetables.

To provide the necessary co-operation with the production and employment departments, suitable interdepartmental committees have been created; and the interest and support of the employees are fostered likewise by committees, made up usually of those who have already benefited by the educational opportunities. Thus, there are enthusiastic committees of the alumni of the night school who solicit new students, and of naturalized immigrant employees who urge their countrymen to join the English and Americanization classes.

The whole program seems to be conceived not as philanthropy or charitable paternalism, but as essential functions of a well-organized productive corporation.

The Essentials of a Plant Safety Organization*

By W. E. WORTH
Assistant Manager, Industrial Relations, International Harvester Co.

WEBSTER defines essential as "constituting or making that which is most important in a thing." Our question therefore is—what are the most important things in a safety organization? To the speaker, there appeal seven prime essentials, and they are given in the order of their importance, namely:

1. A sincere desire on the part of the management to reduce accidents.
2. A willingness by the management to intelligently spend sufficient money to achieve results.
3. A realization by the management that constant and intelligent effort is necessary.
4. A man supervising the work who truly believes a safer operation is possible.
5. An organized group of superintendents, foremen and workmen, all working to a common end.
6. A definite policy and procedure adopted by management and men, and that policy and procedure adhered to.
7. Unflagging enthusiasm.

If these seven prime essentials are accepted as a basis for your conduct the mechanics of organizations can readily be determined. Briefly, these are:

Committees of foremen and workmen, organized for the sole purpose of assisting in carrying on the safety propaganda. These committees should meet at stated intervals to discuss accidents and ways and means of prevention. Considerable discussion in the past has not settled the question of whether there should be joint committees of foremen and workmen, or independent committees. Either will produce results.

Plant inspection by committees. The committees should be given the privilege of making inspection (either jointly or independently) for the purpose of determining the possibilities of improvement in the methods of operation. Many valuable suggestions are received through the medium of these committees.

The work of the safety organization should be based on standards. Have a proper standard for men, methods and machinery. From lack of proper standards arise accidents.

There is a cause for every accident. Find it. If men, educate them; if methods, correct them; if machinery, surround with proper safeguards. It is very important that you devote considerable time to these three factors. Regardless of the enthusiasm you may arouse for safety work, if the three above mentioned factors are not controlled, definite results cannot be had.

Educate the foremen as well as the workmen. The foreman is your mainstay in accident prevention.

In the process of education of the workmen, particular attention should be given to the new man. He should be given a thorough schooling in safe practices by the foreman or one of the older employees in his department. Too much attention cannot be given to this work.

An analysis of the personal injuries and damages to machinery will show (at least it has been my experience) that a very large percentage of the cost is the result of failure to instruct and introduce the new employee.

Safety committees should have as members men who understand the various languages spoken in the plant, thereby conveying what you are trying to accomplish by spoken word to all the employees. Creating enthusiasm for safety work among those employees who do not speak the English language is of very great importance. When once they are convinced that here is a service which will benefit them personally, it is surprising the results that can be obtained and the suggestions which they will make. For that reason, it is, as before stated, very important that you have competent men speaking foreign languages on safety committees.

Bulletins should be interesting and easily understood. In addition to the bulletins which you receive from the National Safety Council, you can well afford to give considerable thought and time to devising bulletins of local and plant interest. Make these bulletins dignified and illustrate them in a way that is effective.

Safety signs should be liberally used. Make the wording brief and give it a "punch." The argument may be advanced that these signs are not read. The fact remains, however, that the secret of advertising is repetition. A multiplicity of signs results in a continuous affirmation of the importance of playing safe. Affirmation and repetition result in contagion. It is therefore important to use as many signs as consistent.

Every practical suggestion should be put into effect. If a suggestion is not used, it will pay to spend sufficient time to properly explain the reason. If it is not convenient to personally explain to the employee, then an acknowledgement of the suggestion and an explanation should be made by letter. However, it is much more satisfactory to personally discuss the matter with the man. An employee will very soon discontinue making suggestions if he is not acquainted with the fact that his suggestion has been considered. On the other hand, if the suggestion is acknowledged even though not used, it will be an inspiration to make suggestions in the hope that some day he will make one that is practical.

*Delivered before the A B C Session of the Ninth Annual Safety Congress of the National Safety Council, Sept. 28, 1920.

Comparative statements of injuries can be used to great advantage in creating departmental or works competition. There has been considerable discussion in the past as to the basis for computing these statements. That, however, is a matter which should be worked out to the best advantage in your particular industry and condition. If it produces the desired result, the method of computing the statistics is immaterial.

Investigate All Accidents

Every accident, particularly those of a serious nature, should be thoroughly investigated and the cause determined. Accidents which are the result of the failure of men, material, or methods, should be brought to the attention of those concerned, and wherever possible bulletins should be issued telling the cause and how the accident might have been prevented.

Solicit the assistance of the folks at home, the principals, teachers, and children in the school and of the community as a whole. The work within the plant is materially affected by the conditions existing outside the plant. You can well afford to give a reasonable amount of time to the education of the citizens in your community. This will be reflected in the conduct of the men in the plant.

Continually bring to the attention of your employees that it is not necessary and is very foolish to take a chance. The chronic chance taker should not be allowed to associate with men and women who are making a conscientious effort for a safer operation.

Diversify your methods of appeal. If it is true that "variety is the spice of life," so also is it true that variety contains enthusiasm in this work. At no time can the organization charged with the responsibility of a safer operation consider that it has reduced accidents to a minimum. You must keep everlastingly at the work.

Behind the mechanics of a safety organization there lies the spirit of the movement. Your manager is primarily interested in producing a profit out of the business and is a busy man. It is your duty, therefore, to keep him advised by means of proper statistics and reports of the benefits arising from this organized effort to make your plant a safe place to work. Keep him advised of the human side of the work. The benefits therein are numerous and unending. You must ever maintain in him a sincere desire to reduce accidents. Show him the importance of spending money to safeguard dangerous places and correct improper practices.

Eternal Vigilance Is the Price of Safety

Demonstrate to the management the need of constant effort—"Eternal vigilance is the price of safety." You must absolutely believe in the work, and maintain personal enthusiasm as well as the enthusiasm of your co-workers. Keep your supervisory group working for a given result. Running around in a circle may be good exercise, but we get nowhere. It is therefore necessary to give them a definite goal for achievement. If the goal is reached, you can always set a new mark.

The men who are making the goods that pay the wages and produce a profit necessarily give first thought to production. By making constructive suggestions as to safe practices, you can build a safety organization that will produce the desired result—namely, a minimum of accidents by a safer operation without interference to production.

Properties of a Non-Magnetic, Flame, Acid, and Rust Resisting Steel*

By C. M. Johnson
Director of Research Department, Crucible Steel Co. of America, Pittsburgh, Pa.

The steels here described were studied by the author for a period of a year or more with a view to producing a steel that could be forged, rolled or sheared in thicknesses of 0.01 to 1 in. or more, and that offered the maximum resistance to the attack of the oxyacetylene flame. It was also demanded that the steel be machinable and that holes could be drilled in it. As the results now stand, a steel has been produced that has certain unusual properties which are briefly described as follows:

Non-Magnetic Properties.—As to the non-magnetic features, a permanent horse-shoe magnet that is capable of suspending in the air a 500-gram weight, will attract only the finest particles. Or, if a piece of the steel be shaped into a compass needle supported on a needle-point bearing, it is attracted but slowly if a magnet of the size mentioned be brought to within a distance of about one-half inch of the end of the needle.

The following report was received on these steels: "Neither the Esterile nor the Leibling apparatus showed any indication that either grade No. 1 or No. 3 could be magnetized in the natural bar or after quenching in oil or water from 1,900 deg. F.

"The permeability with respect to air is 1.04, and after oil treating 1.05 (H. Max. 300). The residual magnetism after charging did not exceed 4 lines per square centimeter. Both of these samples in all three conditions can be considered non-magnetic."

It has been noted that prolonged heat will cause an increase in its attraction by a magnet. The cumulative effect of many hours heating at the most favorable temperature is being studied further.

Rust Resistance.—These steels will remain for many days immersed in ordinary drinking water without developing any rust stains. In making such tests all roll or hammer scale must be removed as the action of water on scale causes rust stains. They show the highest resistance to all fruit acids and staining in general.

Table I shows the resistance to acids of the non-magnetic, acids, flame and rust resisting steel compared to some other metals and steels. The metals were in sheet form and immersed for 24 hours at room temperature in acids. The loss in weight is given in milligrams per square inch of exposed surface. These tests were made in samples from which all scale was removed.

TABLE I. LOSS OF WEIGHT WHEN IMMERSED IN ACIDS

Non-Magnetic, Flame, Acid and Rust Resisting Steel

Grade	Glacial Acetic	20% H_2SO_4	10% H_2SO_4	32% HNO_3	HCl 19%
No. 2-2 oil 2000° F.	0.15	85.9	50.8	0.93	67.1
No. 2-2	0.26	86.1	68.3	0.26	99.2

Other Metals and Steels

Grade	Glacial Acetic	20% H_2SO_4	10% H_2SO_4	32% HNO_3	HCl 19%
High Cr Ni steel	7.93	1045.0	111.3	0.27	462.8
High Cr Si steel	0.00	2180.0	.....	0.50	.....
25 per cent Ni steel	7.81	9.0	11.0	1683.00	22.3
38 per cent Si steel	13.80	4.1	4.1	3459.00	19.0
Wrought iron	19.30	11.22	490.0	1715.00	261.5
Copper steel	12.20	96.3	73.4	2126.00	201.2
Monel metal	0.70	1.2	1.3	2157.00	13.1
High Cr steel	0.67	2062.0	1262.0	0.10	437.3

*From a paper read at the convention of the American Society for Steel Treating, Sept. 15, 1920.

It is an interesting fact that in some of these grades, the scale is dissolved by glacial acetic acid, discoloring the acid, whereas the steel from which the scale has been thoroughly ground off will show no loss of weight and will not discolor the acid.

TENSILE STRENGTH—Table II gives values for the tensile properties of the steel.

TABLE II. TENSILE VALUES OF THE RESISTANT STEEL

Grade	Elastic Limit	Ultimate Strength	Per Cent Elongation	Per Cent Reduction	Brinell	Treatment
No. 2-1	107,270	146,870	25.5	40.1	302	Nat. condition

This class of steel has an extraordinarily high reduction and elongation at temperatures that would burn anything but high-speed steels.

Grade 2 attracts attention in this respect, that even at 2,450 deg. F. the reduction is 69.3 per cent, the elongation 65 per cent in 2 in. and the tensile strength 103,090 lb. Grade No. 3 at 2,200 deg. had a reduction of 64.3 per cent, an elongation of 50.5 per cent and a tensile strength of 111,170 lb. per square inch.

RESISTANCE TO FLAME.—The steel when attacked by the oxyacetylene flame requires twenty times as long to melt a hole through it as it does to melt a hole through ordinary steel.

High chromium steel after 30 minutes exposure to oxidizing flame in a gas furnace at a temperature of 2,000 deg. F. loses 520.5 milligrams per square inch of exposed surface. The flame-resisting steel suffers only a slight staining and a slight gain in weight per square inch after many hours heating at 1,900 to 2,000 deg. F.

Table III shows resistance to scaling of the nonmagnetic, acids, flame and rust resisting steel compared with some other metals and steels. The specimens were ground smooth, weighed and measured, then heated to 1,150 deg. C. for one-half hour in a gas furnace, cooled in air, weighed again and the loss or gain in weight calculated to milligrams per square inch.

TABLE III. SCALING ACTION DUE TO HEAT

Non-Magnetic, Flame, Acids and Rust Resisting Steels

Grade	Loss	Gain
No. 2-2	None	4.8 mg
No. 3-2	None	4.6 mg
No. 4-5	0.3 mg	None
No. 5-1	None	None

Other Metals and Steels

Grade	Loss	Gain
Monel metal	33 mg	Adherent scale
96% Nickel	158 mg	No gain
High Cr-Ni Steel	57.1 mg	.....
Grade A Steel	No loss	1.2 mg
High Cr Steel	52	
Copper Steel	967.4	

Building Airplanes for Local Use

BY I. B. RICH

Evidence of the increasing interest in airplane work can usually be found in most sections of the country if we look in the right places. Two small shops in Venice, Cal., a suburb of Los Angeles, are now building special ships for local work. Figs. 1 to 4 show a six passenger biplane with about 50 ft. wings in the shop of the Pacific Aero and Supply Co.

This is twin motored plane, two of the old reliable Curtiss OX-5 motors developing about 100 hp. each, being installed as shown. The motors are mounted between the wings, on each side of the control fuselage. Figs. 2 and 3 are side views showing the fuselage top-

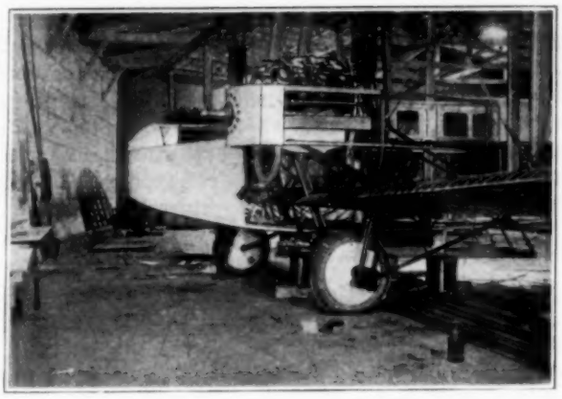


FIG. 1. FRONT END OF 6-PASSENGER SHIP

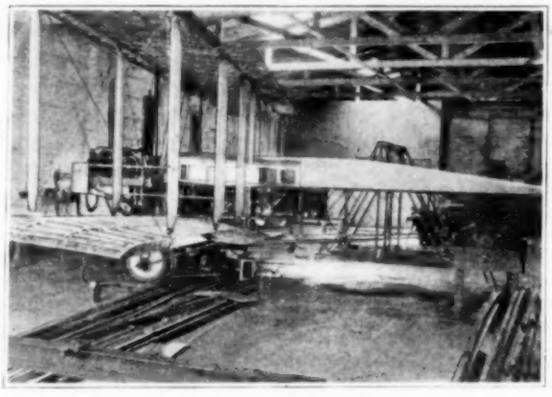


FIG. 2. A SIDE VIEW

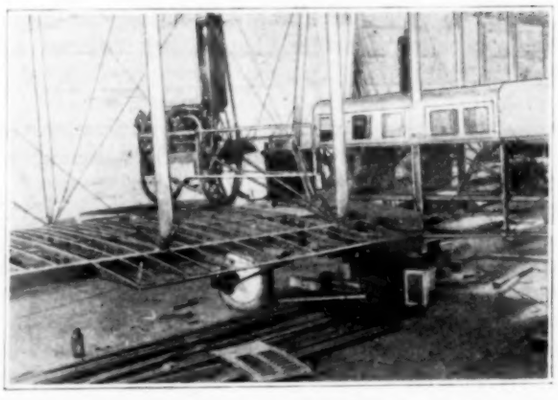


FIG. 3. THE MOTOR AND COCKPIT

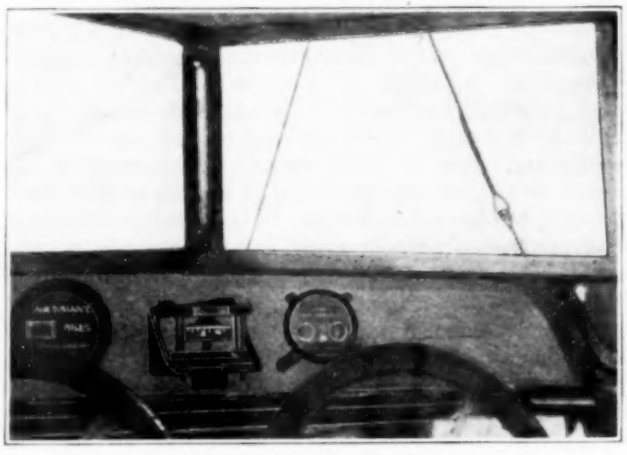


FIG. 4. THE INSTRUMENT EQUIPMENT

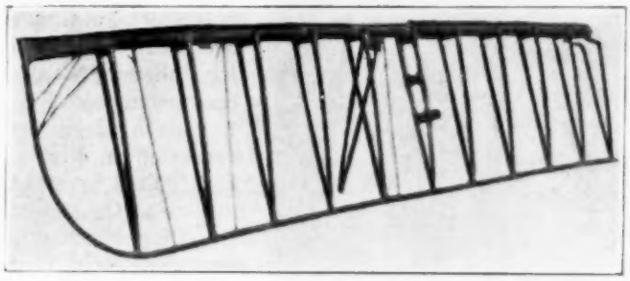


FIG. 5. STEEL AILERON FRAME

FIGS. 6 AND 7. PLANE AND CENTER BRACES

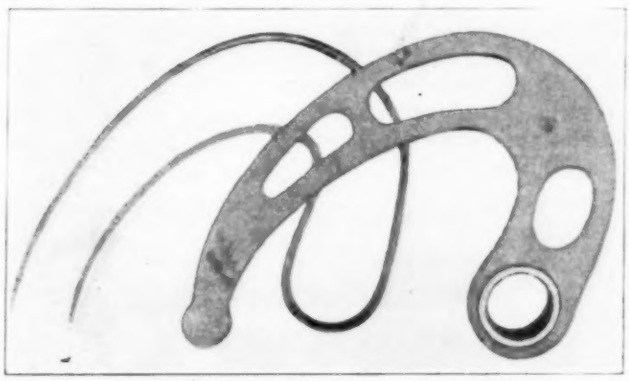


FIG. 8. AILERON CONTROL ARM

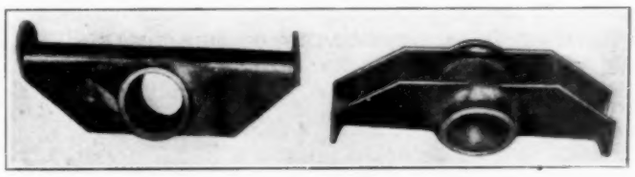


FIG. 9. HINGE FITTINGS

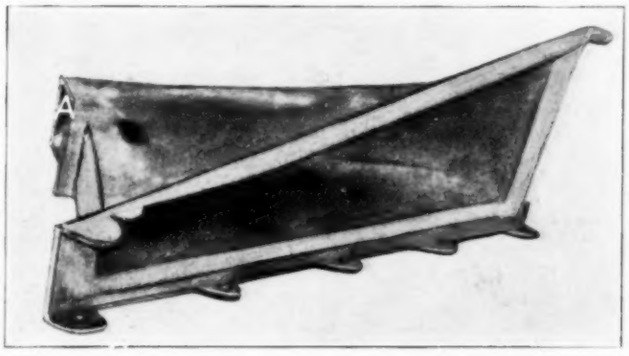


FIG. 10. TAIL SKID FITTING

cover in place. These views also show the windows in the body or passenger compartment, though the wicker seats are not very distinct. The mounting for the motor is also shown very clearly as well as the radiator and the landing wheel and strut.

The interior of the pilot compartment, with a view of the instruments, is shown in Fig. 4. The board includes a tachometer, a Navy type compass and a banking indicator, while on the center post of the sash is an air-speed indicator. The instruments, with the exception of the tachometer, are all special designs of the Pioneer Instrument Co., of New York.

Nearby is the shop of W. D. Waterman, who was an experienced flyer and instructor during the war. He was building a modified LaPere plane for local use at the time of my visit. This has now been completed and is a beautiful example of aircraft building. One of the modifications in this plane is the steel-framed aileron shown in Fig. 5. This view shows how the aileron is built up and the part which oxy-acetylene or arc welding plays in modern construction of all kinds. It will be noted that the braces each side of the center are plain, while the center one is reinforced, these parts being shown in detail in Figs. 6 and 7.

The remaining views show special fittings, sheared, punched and drawn from flat stock and welded. Fig. 8 is a curved arm for operating the aileron and consists of two flat sides and a center distance and stiffening piece which is shown at the left and illustrates a simple way of building up a very stiff and substantial fitting.

Another fitting, for hinging the aileron to the wing proper, is shown in two positions in Fig. 9. It is also built up and welded around the tube which forms the bearing.

The last fitting, Fig. 10, is a very substantial tail-skid frame which is an excellent piece of sheet metal work. The long, tapering side fits up against the lower side of the fusilage frame, while the tail skid itself fits in the opening at *A* and is supported by the whole length of the lower floor of the fitting. This fitting is a particularly good job of sheet metal work where parts are shaped by hand because of the small production required.

How Is the Light in the Drafting Room?

BY WILLIAM H. KELLOGG

In your recent editorial referring to what the real meaning of the term "production man" is, you mentioned the benefits and advantages that are gained by beautifying the surroundings of the factory with flowers and the like. There can be no doubt that such things have a tendency toward increased production and the writer believes that they should be encouraged by all means. There is, however, a suspicion that among some of those so-called production engineers the tendency is to follow that idea too literally.

This suspicion is suggested by the fact that at the plant of a certain large manufacturing concern there is a beautiful array of grass, flowers and fountains over its grounds as well as many other things that show the good-will of the employers in their effort to make the workers comfortable and happy, while on the other hand many obvious points of efficiency are overlooked.

For instance, in the drafting room, which covers a vast area of floor space, the tables, inadequately small,

are crowded together, the majority of them placed in the middle span furthest removed from the daylight, while a larger number of files and storage cases are located near the windows. Then to add to the bad condition there is a lack of sufficient attention to keeping the light circuits in order with the result that the draftsmen sometimes go for days without enough light.

It is a matter of general observation with the writer that this question of proper lighting is a thing sadly neglected in a large number of drafting rooms. Can it be that the average employer supposes that it is well enough to wait until a draftsman calls for light before it is supplied to him? If such is the case, the employer is the loser, for the work of a draftsman cannot be easily measured, and he will, naturally and sometimes unconsciously lag with his work when he finds it difficult to see plainly.

The basis upon which efficiency methods rest, according to Mr. Taylor and perhaps many other modern engineers, is in relieving the worker of the necessity of providing those conditions which are needed for the best results. For this reason such matters as light and space should be as carefully and freely provided as oil is provided for a machine.

I suggest that all who are concerned with the management of drafting rooms make a few observations and see if the writer is not justified in calling attention to these small but important points in drafting-room economy.

Tools for Boring a Seat for a Ball Joint

By Frank A. Stanley

The ram, or slide, of the heavy punch presses made by the Gilro Machine Co., Oakland, Cal., is operated by ball-ended connections from the crankshaft fitting in spherical seats formed half in the top of the slide and half in caps attached thereto. The slide and cap construction is shown in Fig. 1, the caps being lifted from their places to allow the interior of the spherical seats to be seen.

These spherical seats are bored in a drill press with the aid of a pair of special cutter bars, Figs. 2 and 3. The roughing bar is fitted with a pivoted cutter head which is operated by a scroll ended plug engaging with teeth on the cutter head.

FIG. 2. THE BORING TOOL AND REAMER USED IN MAKING THE BALL SEATS

Both roughing and finishing bars are operated in a bushed jig, shown in the background of Fig. 1 and in place for operation in Fig. 4. It is bolted by eight screws to the top of the slide in exactly the same way that the caps are afterwards attached for service. The roughing tool bores the seats practically to completion in one or more cuts; the second cutter being really more in the nature of a flat, spherical formed reamer. The first boring bar is fitted with a flexible or floating holder for the driving shank so that alignment of the bar is always secured when once it is slipped through the guide bushing.

The cutter is a single pointed tool secured by a set-screw in the swiveling head. The latter is pivoted to revolve about its axis when the scroll spindle is turned. With the cutter adjusted around toward the midway position the entire head slips easily into the bushing. The action of the scroll member on the cutter head teeth is practically the same as that of an ordinary chuck scroll upon the teeth at the back of the chuck jaws.

The finishing tool, or flat reamer, is $\frac{3}{4}$ in. thick and offset across the center as seen in Fig. 2 so that the cutting edge around the circle is always in the central plane of the cutter bar, thus assuring the correct form to the finished seat.

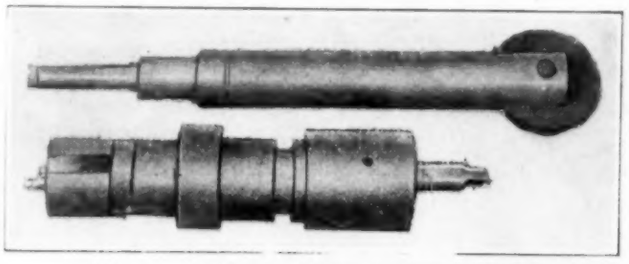


FIG. 3. ANOTHER VIEW OF THE TOOLS

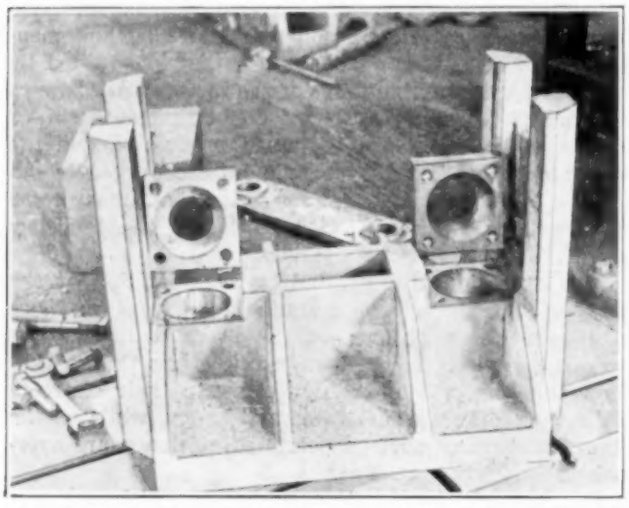


FIG. 1. THE SLIDE, SHOWING THE SEAT FOR THE BALL ENDS OF THE ARMS, AND THE CAPS

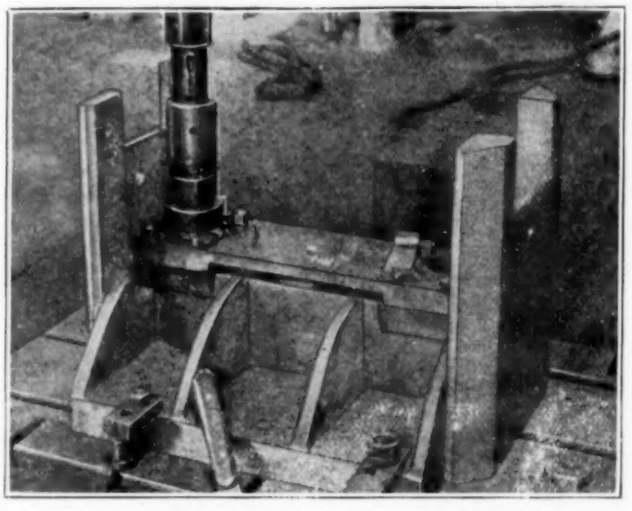


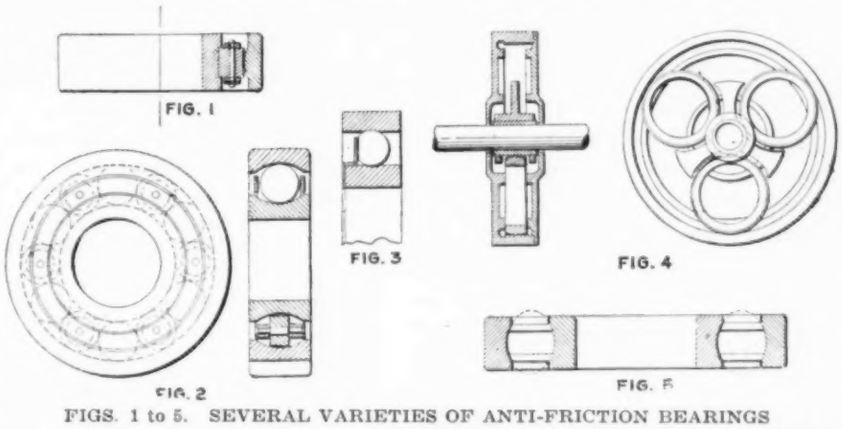
FIG. 4. THE BORING TOOL IN OPERATION, SHOWING HOW THE JIG IS USED

What Is the Difference Between Roller and Ball Bearings?

BY A. DANIELSON

Bearings characterized by rolling rather than sliding action are usually classed as either "ball" or "roller" bearings with attendant confusion due to the many varieties of both types. The author offers suggestions for a definite classification of these two types.

IN BEARINGS where sliding friction has been superseded by a rolling friction, i.e., in "anti-friction bearings," there are to be found rolling elements of widely varying shape. The early types of anti-friction bearings were either ball bearings or roller bearings. Some of the reasons for employing balls in bearings were, no doubt, that balls can be manufactured comparatively easily and cheaply and that the ball need not be guided in the bearing but may be allowed to roll on any of its peripheries, which simplifies the construction of the bearing. Roller bearings have from the start been competitors of ball bearings in carrying heavy loads. In the early roller bearings cylindrical rollers were employed mainly for the sake of ease of manufacture. A supposed distinction between ball and roller bearings which has often been mentioned, is that balls have a point contact on the raceway, whereas rollers have a line contact. This distinction will not hold in all cases, however, as there are now existing types of bearings which unquestionably must be classified as roller bearings, but which have a point contact, as for example the bearing shown in Fig 1. As a matter of fact, the two kinds of bearings, while originally distinctly different are today not so easily recognized or classified on account of the existence of several types intermediary between the two. For several reasons it is highly desirable that a clear definition be recognized for the classification of an anti-friction bearing.



FIGS. 1 to 5. SEVERAL VARIETIES OF ANTI-FRICTION BEARINGS

Fig. 1. Roller bearing with point contact. Fig. 2. Bearing with both balls and rolling elements. Fig. 3. Axis of rotation unalterable. Fig. 4. Rolling elements with spherical working surfaces. Fig. 5. Rolling elements not having spherical form

This classification can be accomplished in three different ways; namely, (1) so that only bearings having whole balls rotating freely around any axis are called ball bearings and all others roller bearings, (2) only those having cylindrical rollers are called roller bearings and all others ball bearings, (3) all intermediary types are classified each on its own merits. Still another way out would be to introduce a new name for the class of debatable types, which, however, should not be done unless all other ways fail. Examples of types intermediary between ball bearings and roller bearings are shown in Figs. 2 to 5. These have all been obtained from various letters patent and have been selected not with a view to their suitability for bearing purposes or any other practical points, but solely on account of the interest which may be attached to their attempted classification.

An examination of Figs. 2 and 3 raises a doubt as to their proper classification. In these bearings the rolling elements can not rotate freely, inasmuch as their axis of rotation is predetermined and unalterable. The bearing in Fig. 2 may always have to be considered an intermediary type, as it has, alternately, ordinary balls and other shapes of rolling elements which may be considered as either balls or rollers.

The design shown in Fig. 4 can hardly be classified as a ball bearing, unless ball bearings are defined as anti-friction bearings, the rolling elements of which have spherical working surfaces. Fig. 5, unquestionably, must be classified as a roller bearing, as in this design the rolling elements do not have a spherical form. If consideration should now be given to the question of the proper place for a line to be drawn between ball bearings and roller bearings, without violating either the established language or the laws for logic reasoning, it would be found that if the second of the above-mentioned ways of classification were adopted, and only bearings having cylindrical rollers were to be called roller bearings, a number of absurdities would follow. There are many types of bearings with conical rollers, or rollers having a concave contour which cannot possibly be called ball bearings, but whose rolling elements cannot be simply or unquestionably defined.

Now, should the other extreme be resorted to, and ball bearings be considered to include only those anti-friction bearings where the rolling elements have a spherical form and can rotate freely on any axis, all others being called roller bearings, then no absurdities are encountered. Thus it would not be absurd to term the type in Fig. 3 a roller bearing. For this reason then, it can be stated that it is easier to logically define the ball bearing than the roller bearing.

The question now remaining is: Would it be well to extend the definition of the ball bearing so as to comprise in it all anti-friction bearings having rolling

elements with spherical working surfaces? In that case there would be encountered the difficulty of determining whether a surface be spherical or only nearly spherical. Cases could be conceived where it would be necessary to take apart a bearing and to resort to instruments of high precision in order to establish its classification. The line between ball bearings and roller bearings would then be determined not by the constructive features of the bearings but by the dimensioning of the rolling elements. The same difficulty, only to an even greater extent, would have to be met, if the definition of the ball bearings should be still further extended to include those bearings having rolling elements with a nearly spherical surface. It seems, therefore, that it would be most closely adhering to the original meaning of the expression ball bearing, as well as being most logical, to define the ball bearing as an anti-friction bearing having its rolling and carrying elements of a spherical form and free to rotate around any axis. All other bearings having, for rolling and carrying elements, bodies of rotation, should then be classified as roller bearings.

Applying this definition, then, the types shown in the five illustrations should all be classified as roller bearings.

What Is a First-Class Machinist?

By R. McHenry

There has been much discussion in recent numbers of the *American Machinist* as to "what constitutes a high-grade machine" and as to just "what is a machine tool," and the subjects have been very ably handled. A kindred problem that seems to be puzzling many employers and employees at present is, "What is a first-class machinist?"

One shop manager used to say to prospective help, "No, I don't want a first-class machinist, I want a *good man.*" It is evident that the term "first-class machinist" meant little to him. In another case a workman stated that he was a machinist and rated first-class. On being asked about his recent work, etc., he said he was a first-class turret man. As the shop in question had no turret lathes or prospect of acquiring any, this "first-class man" could not interest the foreman.

In this age of specialization it seems hard to place a man without first obtaining his life history. For instance: men employed in machine shops are usually spoken of as machinists. Many of these, however, have served no time at the trade; but as operators of certain machines they are much more valuable than some journeymen who have spent a lifetime in various branches.

Because a man is efficient only in the cutting of gears, he can hardly be classed with the "all-round" mechanic, and yet, the "all-round" man, while considered good on a large variety of work, very likely would be unable to figure out and cut a simple pinion.

During the war, a workman became connected with a shop which was having the usual difficulties with inexperienced help. After the settlement of their contracts this machinist sought work at another local plant doing a high class of work. He was reluctantly hired and given more or less rough repair work, etc. The foreman later remarked with surprise that the new man seemed to carry through every job he was given in some way or other. He was then told that the man in question could claim an experience nearly as general as himself and had worked for years in factories building various kinds of machinery.

Some shopmen have all their work laid out by draftsmen and detailers, even to the finish of machined surfaces. Others are expected to build entire machines from a mere pencil sketch and a survey of the castings. All seem to the lay public to be in the same category.

A marine mechanic often finds difficulty in a shop on land. Also many men employed by steel mills, shipyards, railroads, etc., and rated high as machinists, make a much different impression on manufacturers of typewriters, firearms, and electrical apparatus.

Advertisements for "first-class machinists" are numerous and men claiming the title are legion; but just what is a "first-class machinist?"

Efficient Pattern Making

By M. E. Duggan

The other day while at the foundry, my attention was called to a pattern that for artistic finish had most other patterns wiped off the map, but there was a doubt lurking in the mind of the molder as to whether or not the pattern could be molded. Upon my return to the rolling mill I picked up the *American Machinist*, issue of Sept. 9, 1920, and read upon page 516 the very interesting and instructive article entitled "Efficient Pattern Making," by E. A. Dixie.

Mr. Dixie describes, with the aid of illustrations, how the foreman pattern maker made, in one day, a pattern from which a satisfactory casting was produced. Ordinarily this pattern would have required from six to seven days to make in the regular way.

In the first instance the pattern maker is an artist; the foreman pattern maker referred to by Mr. Dixie is a "mechanic." He knows foundry and molding practice. If he did not know molding practice and how far he could go in making a cheaply constructed pattern with the material at hand, he would have made the pattern in the regular way and by so doing, held up the job six or seven days. Let's have some more of this, Mr. Dixie, it's good stuff.

Speaking about "service" in the pattern shop, the following might be of interest: A spur gear 6 ft. 6 in. in diameter, 5 in. face, 6 arms, and bored for a 5½-in. shaft, broke. The machine must be kept going and producing. What was to be done? Make a new pattern, or section of a pattern; or send out of town to have a new gear made?

A knowledge of molding practice helped to solve the question. What was done is worth knowing in a "pinch." A search of the pattern loft in a nearby machine shop resurrected an old discarded pulley-arm core box, 6 ft. long, or about 3 ft. longer than the arm for this gear job. For the hub an old piston pattern was picked up in the foundry; this was 1¼ in. longer and 1 in. larger in diameter than the hub on the broken casting, a very good fault in a pinch. A rough pattern for one sixth section of the rim was made.

From the side of the hub to the inside of the segment was the length of the cores for the arms. This length was marked off on the core box and the cores for the six arms made and baked in the night oven. The casting was poured fourteen hours after the break occurred. To do a job like this you must *know* molding methods.

How the $5,000,000,000 Slump in the Price of Farm Products Will Affect Industry

The answer to the above title is that it is in the hands of labor itself. This article, reprinted from the Oct. 15 issue of "Industry," gives a pessimistic though forceful outline of the facts in general.

WHAT would it mean to the country should $600 a year be cut from the income of half the families in the United States? This is a simple question, but the facts underlying it are of the most stupendous character; of such a nature, in fact, that sooner or later they must engage the attention not only of every economist but of every man, woman and youth who works for wages. When it is added that this cut is falling not upon the wealthy but on the class whose cash incomes, taken as a whole, are smaller than almost any other, another angle of the proposition is presented which gets down very close to the individual.

The recent slump in the price of farm staples means nothing more or less than that approximately 49 per cent of the people of the United States must suffer a material reduction of annual income amounting in the aggregate to the terrific sum of $5,000,000,000; the people affected represent 40 per cent of the purchasing power of the American people. Let us first get at the facts before attempting to draw conclusions as to what effect this enormous loss will mean not only to the farmers but to all workingmen and women.

Corn, with a 3,000,000,000-bushel crop in sight, has slumped from $1.80½ on June 28 to $0.84½ on Oct. 6.

Wheat, with a 800,000,000-bushel crop, or larger, has slumped from $2.80 on June 28 to $1.90 on Oct. 6.

Potatoes, with a crop in excess of 400,000,000 bushels, have slumped from $2.50 to $3.00 early in the season to $1.50 or less at the present time.

Cotton, with a 12,000,000-bale crop, has slumped approximately 20 cents a pound or $100 a bale.

These four items alone aggregate a total slump in prices, measured in values based on the total crop, of a little more than $5,000,000,000. The decline in corn is more than 50 per cent, in wheat about 30 per cent, in potatoes 40 per cent and in cotton 50 per cent. Oats have declined from $1.18 to about 84 cents. With few exceptions, notably dairy products and eggs, declines ranging from 25 to 50 per cent are indicated for every important farm commodity; and the prices for butter and eggs cannot remain at their present levels indefinitely, if for no other reason than that the great decrease in purchasing power suggested by these shrinkages in time will be reflected in the cities and towns from which the farmer must draw all his supplies except his food. Here, in fact, the gist of the whole situation as it affects the workingman is suggested, although we have not yet reached that stage of the discussion. We pause here only to explain that the farmers cannot cut $5,000,000,000 from their town purchases without either closing many factories or reducing wages or both; and when wages stop prices fall—whether of butter, eggs or phonographs.

The workingman in industry will be affected in still another way. A price decline of this magnitude would force bankruptcy in any industry other than agriculture (it would in that if agriculture were composed of great instead of small units). It will gravely affect agriculture, accentuating the dissatisfaction already existing on the farms and accelerating the exodus from the farms to the cities, thus leading to a labor surplus in industry which in turn will produce an inevitable reduction of wages that cannot be stemmed, for men and women will refuse to starve in the cities merely to maintain the present high level of compensation in industry. Adjustments of this nature are not forced by the employers but are the natural result of conditions which manufacturers would be only too glad to prevent if they could. Indeed, it is a statement easily susceptible of proof that employers would raise no objection to a continuation of the present wage level if (1) their markets would hold up and (2) the employee would return a full measure of work for the money he is paid. The more the situation is studied, however, the more clearly it becomes apparent that within a twelvemonth the secondary reaction herein described threatens to make conditions in the cities worse than on the farms, where at least food is plentiful. It is to forestall such a situation, if it be humanly possible, that all concerned will need to study and realize the facts, and not be misled by labor agitators who would add fuel to devouring flames by shouting that they will spend the last drop of their blood to prevent any reduction in wages.

The drop in values of farm commodities will affect the farmers quickest in their purchasing capacity. As already stated, the people on the farms include approximately 49 per cent of the people of the United States and constitute fairly 40 per cent of the purchasing power of the country. Lopping $5,000,000,000 of receipts from the income of 8,000,000 families means cutting more than $600 from the potential spending power of each family; money which cannot be spent on city products because it is not in hand. This enforced economy is to be measured in automobiles, pianos, talking machines, men's suits, dresses and dress goods, furs, shoes, harness, wagons, furniture, electrical appliances, rugs, carpets, confectionery and a thousand other things. In all these lines sales will fall off in a tremendous proportion of goods which doubtless would be made and sold were the conditions of the last two or three years to continue. The railroads will suffer from lack of patronage, both freight and passenger, and the demand for the products of the mines will be materially reduced. No class of wage-workers in the country can be mentioned that will not experience the direct effects of this stupendous cessation of country purchasing. One of the most common expressions of the times has been: "The farmers never had so much money in their lives. They are having as much and living as well as the people in the cities." Unfortunately this prosperity cannot continue with the prices of farm products cut in half. All this, we may remark parenthetically, is merely another way of saying forcefully and illustrating graphically that American industry cannot be permanently or temporarily prosperous unless American agriculture is prosperous.

The time has arrived when the American business man and the wage-workers must take account of facts which cannot be blinked at. By the same token that the city cannot prosper unless the country makes money, the city profiteer must go when the country profiteer goes, be he capitalist or laborer. Obviously the cost of farm labor must be reduced if a large proportion of the employing farmers' income is to be swept away; and with the country market whittled down, the spending money shut off, the prices of manufactured goods and the labor that produces them must come down. It is not that anyone wants the present "golden era" to end, but that the end is in sight already, and capital and labor alike must adjust themselves to the change.

Strikes No Longer Succeed

It is stating only a solemn fact, not an argument, to say that further increases in wages in the industrial centers have become impossible. It has been an outstanding fact for months that strikes no longer succeed; that fewer are attempted, because most of the wage-workers are sensible people and are not fools enough to risk a long period of idleness in a falling market. But the mere refusal of employers to increase wages is not enough to meet the situation. It may be for a brief period, or until every individual has been able to note for himself the disastrous results of the disappearance of prosperity on the farms; but when the reaction has fully set in and the farmer, by staying at home and hanging onto what money he has, supplies unmistakable evidence that hard times have come, wage reductions cannot be avoided.

In the city of Washington at the present moment 85 per cent of the building industry is tied up by a strike of carpenters for higher wages. Anyone familiar with agricultural conditions as they have been set forth here must know that this strike will fail. So will every other strike of the kind from now on; nor is building likely to be resumed on any large scale until actual wage reductions have taken place. The striker of today is flying directly in the face of industrial providence, and if he cannot read the lesson in advance, if he cannot understand, for example, what so simple but impressive an object lesson as the falling prices of agricultural products teaches, he must lose his time and his money in a vain effort to get what the employer knows he cannot grant.

The important question is whether the workingman and the labor union which represents him in industry will regard and appreciate the situation as it is or will make a bad matter worse by failing to recognize the facts. It has been an axiom of the day that prices will not come down in the cities until unemployment has become more or less general and it has been suggested that manufacturers would shut down their plants for no other purpose than to force a reduction of wages. The absurdity of this idea is apparent on its face, if one will use a little gray matter in considering it; for no business man that is making money while paying high wages ever stops making it merely to cut down the pay of his employees. On the contrary he is glad to pay liberally as long as business holds up.

But the new condition which has arisen in consequence of the serious let down in the price of farm products will relieve the manufacturer of any suspicion that he is conniving at wage reductions; for he, along with his employee, necessarily becomes the sufferer from the loss of trade which the shrinkage of incomes on the farms will entail. Neither will the farming class, with their own business falling and their incomes dropping, listen with patience to the plea of the industrial worker that high wages must continue. Nor will general reductions in wages and prices materially alter the existing situation greatly, if common sense prevails, for the net effect of the adjustments, if they are undertaken fairly and scientifically, will be to add to the purchasing power of the dollar, leaving the general situation relatively where it was before. That is the big fact. Every class will participate in the readjustment and, with reason and not rant at the guide, no one will be hurt.

Use of Cross-Section Paper in Making Charts

By Chester E. Josselyn

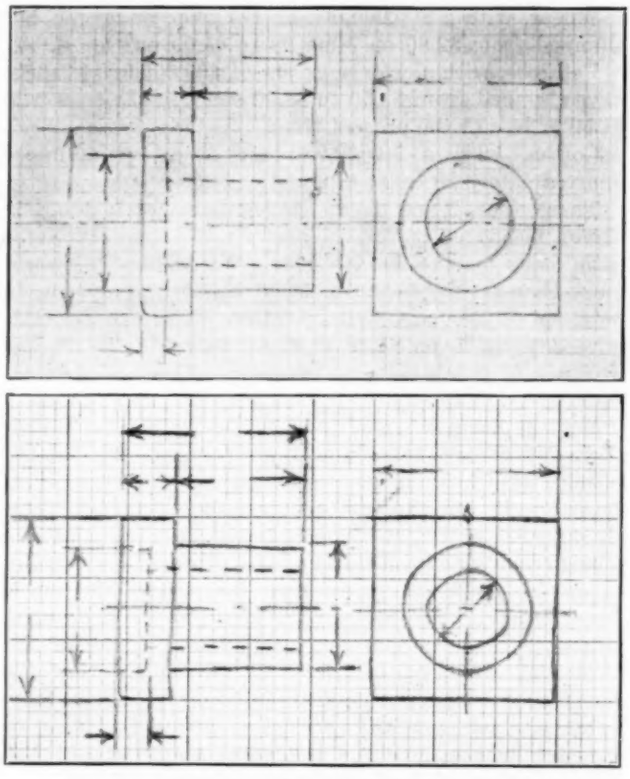
The use of cross-section paper, mentioned on page 16 of the *American Machinist*, was appreciated. Had I used this method in times past much time could have been saved when arranging tabulations.

It suggested for publication a use I sometimes make of section paper which I have never heard of being so used by others.

Just reverse the usual practice of sketching on the ruled side and use the blank side instead.

An impression of the section lines usually shows through on the back which permits using them as guides but they are not so prominent as to confuse reading as when the sketch is on the ruled side.

If prints are to be made it, of course, makes no difference which side the sketch is on, although the objection could be overcome by using the cross-section paper specifically, as Mr. Barr says, underneath the sketch paper.



SKETCH ON BLANK AND RULED SIDES OF CROSS-SECTION PAPER

Some Notes on Tapping

By E. A. Dixie

Someone once said: "The truths of today are the lies of tomorrow" or words to that effect and by the same token the wise things of yesterday may be the foolish things of today, depending on the conditions under which they are done.

Some time ago, while going through a manufacturing plant, I was attracted by an extremely unusual method of machine tapping.

Someone had drilled a large number of holes in some castings. When it came time for these holes to be tapped it was found that they were so small that when the usual method of machine tapping was pursued the taps broke. The holes could be hand tapped by the common method of backing the tap out every turn or two but the tap could not be driven straight ahead without breaking. The drill press on which the attempt to tap the castings was made is equipped with a valve-grinding attachment which makes the spindle rotate almost a complete revolution and then back a small part of one. Someone, wiser than most of us, conceived the idea of securing the tap in the chuck of the spindle and hooking up the valve-grinding attachment and thus simulate hand tapping. The method worked out to the entire satisfaction of everyone; all the holes were tapped and not a tap was broken. It was a wise idea.

The other day I went through the same factory and found the valve-grinding attachment was still on the job tapping holes.

When inquiry was made as to why they used this slow method of tapping they told me that it was the only method by which they could get a full thread. That was where they were foolish.

Remember, they were tapping cast iron and knew or ought to have known that they could not tap a full thread in cast iron and still have a full thread. That last sounds rather Irish but it is a well-known fact that when tapping a full thread in cast iron, the tops of the threads are crowded off by the wedging action of the tap. Besides, even if it were possible to tap full threads, of what use are they? In the case cited the tapped holes in the castings acted as nuts to take the threaded ends of screws which were to attach other pieces. Almost everyone knows that a nut need not have a full thread in order to be as strong as the bolt which fits it, and everyone knows that few commercial nuts have full threads—there is no reason why they should and many reasons why they should not.

Several years ago one of the big electrical manufacturing companies in this country became somewhat concerned over the excessive breakage of taps. The figures have slipped my memory but the tap bills amounted to many thousands of dollars per year. So a committee was appointed to investigate the reason which was not far to seek. The drawings demanded tapped holes to be tapped *full thread*. The next job of the committee was to discover a remedy. A great number of experiments were made in tapping-machine steel, tool steel and cast iron, using various sizes of tap drills with a view to producing a nut which would

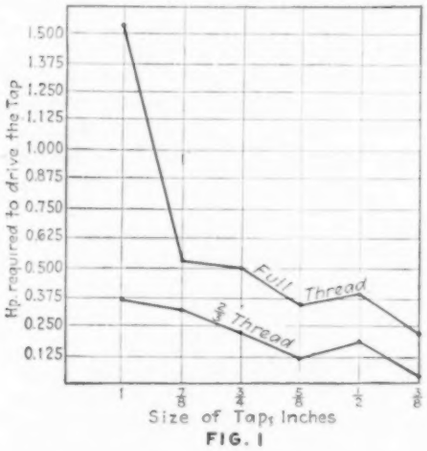


FIG. 1

CHART OF POWER CONSUMED IN TAPPING TOOL STEEL

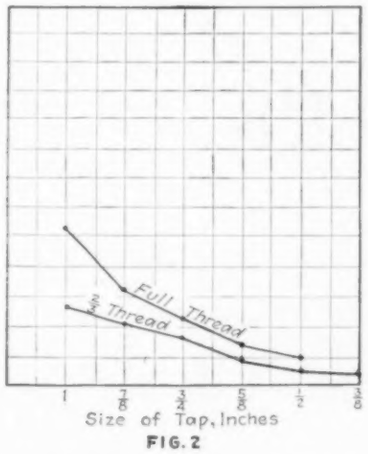


FIG. 2

CHART OF POWER CONSUMED IN TAPPING MACHINE STEEL

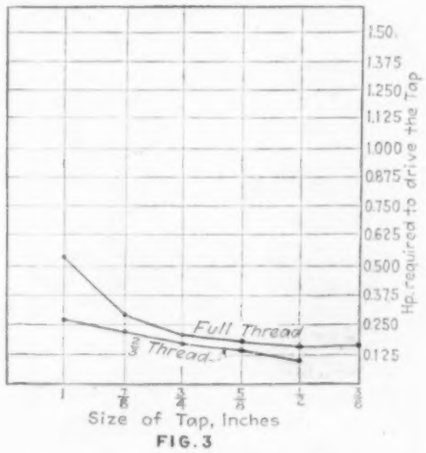


FIG. 3

CHART OF POWER CONSUMED IN TAPPING CAST IRON

be stronger than the bolt and still be easy on the taps. A number of bolts from ¼ in. to ⅞ in. diameter were pulled in two with nuts which had threads only ⅔ of full depth.

Orders were then issued to tap all threads about ⅔ full, with the result that tap breakage was practically eliminated, over 90 per cent of the taps *wore* out in service, and there was a material reduction in the amount of power consumed in machine tapping operations. The accompanying charts were constructed from the average performance of a number of taps, from ¾ to 1 in. diameter.

Fig. 1 is a chart showing the power consumed in tapping full and two-thirds depth threads in tool steel. The hump in the curve at the ½-in. tap was probably due to poorly made taps. It will be noted in all three of the charts that the power curves of full and two-thirds thread depths nearly parallel each other till ⅞ in. diameter is reached. From this point the rise in the two-thirds thread-power curve is about normal in all three of the charts but that of the full thread shows an extreme rise for tool steel and a pronounced rise in the chart, Fig. 2, which shows the power consumed in tapping machine steel and also in the chart, Fig. 3, which shows the power consumed in tapping cast iron.

Summed up, the average power necessary to tap a full thread is about twice that necessary to tap a two-thirds thread and a two-thirds thread is stronger than the average bolt. The objection to a two-thirds thread is that it does not "look good," but when a tapped hole has a bolt in it not much of the thread is visible.

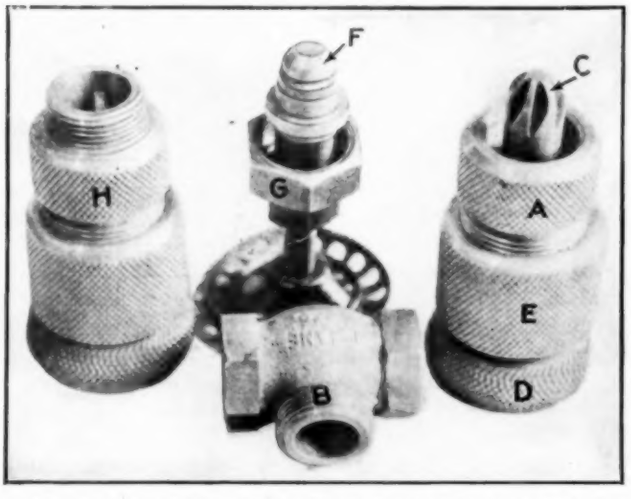
Hand Tools for Reclaiming Globe Valves

By J. H. Vincent

The hand tools shown in the illustration were shown at the convention of the Railway Tool Foremen's Association by W. H. Casson, who had made them for reclaiming globe valves brought into his shop for repairs. Both the seat and the disk of the valves usually require refinishing because of having been scored by the action of steam or water passing through them; this scoring usually being caused by carelessness in closing the valve and thus permitting a slight seepage of water under high pressure.

The tool at the right serves to refinish the worn seats. To use it the internally threaded sleeve *A* is screwed onto the valve body at *B*, bringing the formed cutter *C* into position to resurface the valve seat. The cutter is turned by means of the knurled disk *D*, keyed to its outer end. After inserting the tool so that the cutter rests on the valve seat, the threaded sleeve *E* is turned back on the body *A* of the tool until it contacts with the under side of the disk *D*, and thus prevents the cutter from taking too much metal off the valve seat. The amount removed is gaged by turning *E* forward until the valve seat appears smooth.

The tool at the left of the illustration is used for refinishing the disk *F* and works in the same manner, the shape of the cutter being made to conform to the work. The tool is held in position by screwing the gland *G* onto the body of the tool at *H*.



HAND TOOLS USED FOR RESURFACING WORN VALVES

Have You the "Use of Yourself?"

By L. L. Thwing

Some one in enumerating his few blessings once said: "I am thankful that I have always had the use of myself." Among the palliatives, improvements and cures which are offered for our problems of employment is this desire of a man to use himself always considered?

We are told that every man should have a vocation and an avocation—a trade or profession—and also a hobby; something to interest him after working hours.

Machinists are an adaptable lot, and turn their hands to many different kinds of work. I knew one who built himself a fireplace and chimney for his house; I am intimately acquainted with one whose cabinetmaking is my secret envy and despair.

The desire to make something is born in all natural mechanics. To the man with a hobby—be it garden, workshop, motor boat, or even collecting postage stamps—to have time to follow it is to have the use of himself for his own purposes. Few men enjoy work for its own sake, particularly when the character, methods, and time have been selected by someone else.

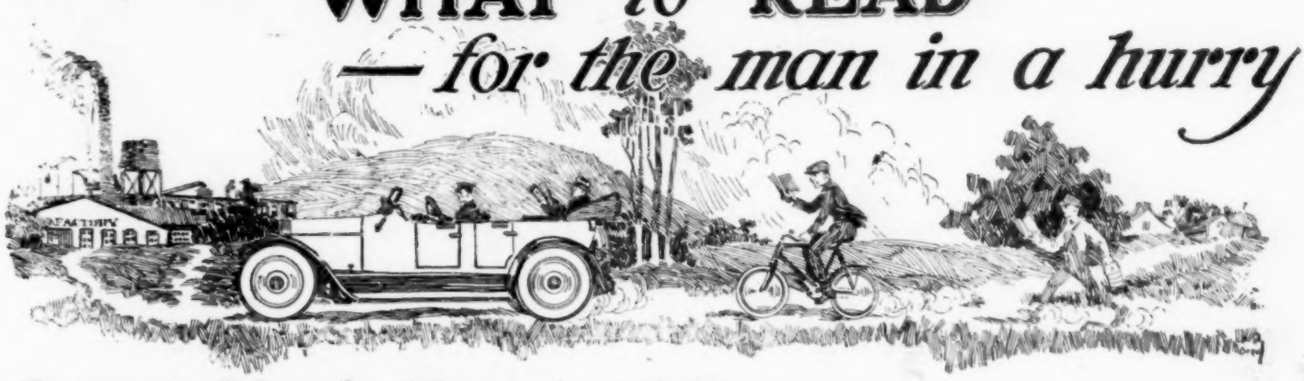
I have had little official connection with the problems of the employment office, but at one time in 1917 when machinists were hard to get, the stereotyped advertisement offering "steady employment, good wages, and excellent working conditions" did not seem to produce results; so I was allowed to try my hand at it. In substance my advertisement read as follows:

"MACHINISTS WANTED—Hours 7:30 to 4:30; 11 o'clock on Saturday."

These were unusual hours in our section but not unusually short; nevertheless the superintendent was able to hire all the men he needed from the replies. And let us not assume too readily that this was because the hours seemed to be shorter and to involve less work; after a man had travelled on the street car for half an hour or more, had his supper and a bit of a smoke over the evening paper, it would be 8 o'clock for those whose shop hours ended at 5:30, and in those days back yard gardens were very popular and daylight was needed for their cultivation.

This is not an argument for a 6-hour day but an attempt to controvert the idea that still persists in the minds of some employers that the only thing a man does with his time outside of working hours is to waste it; forgetting that some of it may be used, and that the men who make good use of their own time are the ones he likes to have in his shop.

WHAT *to* READ
—for the man in a hurry



Suggested by the Managing Editor

MACHINING the Connecting Rods of Two Well Known Motors, the lead-off article by Fred H. Colvin is another of the instructive automotive series. The methods used in the Oakland and Studebaker shops are detailed. They will be found to be of interest to those engaged in large production in the same or similar lines.

The second part of the six-part series "Seven Centuries of Brass Making" begins on page 835. It deals with the crucible process, which, says the author, is basically the same method as used in the middle ages. The current story is to some extent historical in that it tells of the first attempt to cast brass in the North American colonies and explains the relation of Connecticut to the development of brassmaking in the United States.

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots

In these days, when engineering is coming to receive its proper recognition as a profession and the engineer is perceiving the relation that his profession bears to the welfare of the public and the world in general, it is fitting that such a talk as that by J. E. Aldred, page 839, should be brought to the attention of engineer readers. Mr. Aldred's talk was delivered to student engineers but it is so thoroughly general in scope and in the selection of topics that practicing engineers as well will be glad to read it and will feel that they have learned from it. The same is true of executives and those aiming to become executives. "Common Sense in Engineering" is the title.

Ernest L. Little in his story "The Industrial Development of Australia" emphasizes what the *American Machinist* has persistently told its readers, that for export shipment packing is all important. He says, "The primary consideration of the American exporter must be safety of carrying." The subject of packing accounts for only a small part of the article on Australia. Figures are given to show the general growth and the effect of the war on Australia's industries and conclusions are advanced relative to Australia as a market for American exporters.

Not so long ago we ran the last of the Sherlock articles on "Know Your Insurance Policy" which proved of interest and value to many who had to do therewith. An article similar in a general way, in that it takes up an industrial subject of interest to all factors, is the one in this issue, "Medical Aid Under The Compensation Acts." Vital points of the acts are explained and the questions which have arisen on many sides are answered.

This week's installment of the J. V. L. Morris series on "Programs of Apprenticeship" deals with the methods employed at the Westinghouse Electric and Manufacturing Company's East Pittsburgh Plant. Apprenticeship and special training have meant much to the Westinghouse Co. on account of its great number of employees, of whom there are from eighteen to twenty thousand at the East Pittsburgh Plant alone. They have, of course, been given scientific attention with the result that the system used is positive and efficient. Morris's comprehensive report on it is worth careful perusal. Page 847.

The *American Machinist* has always advocated "Safety" and has published a great many constructive articles on the subject. Another of the same type is "The Essentials of a Plant Safety Organization," page 852, by W. E. Worth, Assistant Manager Industrial Relations, International Harvester Co.

There are some plain facts in the article beginning on page 859, entitled "How the $5,000,000,000 Slump in the Price of Farm Products Will Affect Industry." It is stated that those directly affected represent 40 per cent of the purchasing power of the American people. It is easy to conjecture what such curtailment means to industry. There is a lesson for the industrial worker who is inoculated with the high wage germ and who cannot see that there must come a readjustment involving lower wages before the purchasing power of the dollar can be materially increased.

Among the shorter articles are "Properties of a Non-Magnetic, Flame, Acid and Rust Resisting Steel," page 853; "Building Airplanes for Local Use," 854; Tools for Boring a Seat for a Ball Joint," 856; "What Is the Difference Between Roller and Ball Bearings?" 857; and Some Notes on Tapping, page 861.

Machine Tool Prices—Are They Too High?

AUTOMOBILE costs have not decreased, yet prices have dropped all along the line. The farmers are facing a loss of income of fifty per cent, in round numbers five billions of dollars. Cut has followed cut in the textile and leather industries and the end is not yet. In the face of this evidence why should not machine-tool prices follow the same downward course?

There are several reasons. Perhaps the best way to bring them out is to go back a short distance into the history of the machine-tool business. Most of the leading concerns of the present day started business on a shoe string in Civil War days or even more recently. The firm names Brown & Sharpe, Pratt & Whitney, Potter & Johnston and many more show the partnership of ambitious and skillful mechanics to have been the usual form of organization, if the early shops can be said to have had organization. These men had simple standards of living and were content with profits on their products that were disproportionately small. They were mechanics and not business men and they ignored many cost factors that would be considered elementary now. The tradition of small profits has clung to the industry and joined with keen competition to keep prices below the intrinsic worth of the great majority of American machine tools.

The World War made great changes in the machine-tool business and boosted prices to a point that enabled struggling companies to show returns which left something to put into new buildings and other much-needed improvements. This was undoubtedly overdone in some cases, but it shows that the profiteering fever attacked but few victims in our field. Many would have been better off now had they taken more profits to establish reserves and put less back into the plant.

Another factor affecting present prices must not be overlooked. It is sales expense. We know of one big producer who has not sent out a salesman since 1914 except by special request. As a result his selling expense has been practically negligible. If this pleasant state of affairs could continue it might be feasible to do a little marking down, but when a selling charge of twenty per cent is added to present production costs the conservative builder feels more like raising than lowering his prices.

And then there is the matter of service charges. It is common knowledge that manufacturers' service facilities for repairs and adjustments have been and still are abused. Right or wrong, service costs cannot be ignored.

If machine tools could be built on a basis comparable to the mass production of automobiles where hundreds or thousands of a model are put through in a series, there might be some chance of a reduction in price through production savings. But where big machines are built one at a time as ordered and smaller ones in lots of from ten to fifty this is out of the question.

There is a widespread impression that because some makers of automobiles have cut their prices, machine-tool builders should do the same. Just why this impression has gained so much credence is hard to understand. About the only points of similarity between automobiles and machine tools are that both are made largely of iron and steel and that both are mechanical contrivances.

Admitting its obvious value as a time-saver to salesmen, doctors and inspectors and its commercial value in transporting passengers for hire, the automobile is still in the luxury class. We venture to say that only a small percentage of the motor cars of this country are actually making money for their owners, and also that five years is a long time for a car to be in the hands of one owner. A machine tool, on the other hand, is purchased to increase the productive output of human labor and must earn its salt or be relegated to the junk pile. It may last ten years or it may last fifty, but during that time it is always a producer. New models come along just as they do in the automobile field but in the shop they are more apt to represent an addition to equipment than a replacement.

A bargain sale of luxuries will often stimulate a sluggish market but when it comes down to a machine tool, a man either needs it or he doesn't need it. If he has no immediate use for an openside planer, a cut of twenty per cent in the price of the planer will not induce him to buy it. If he does want it he can take delivery at once at the current price and make enough out of it to more than balance any probable price cut before it occurs.

Several accounts have appeared lately of New England mill employees who have voluntarily taken lower wages to keep the mills running. It would be most unfortunate to have to resort to such an expedient in the machine-tool business for the simple reason that the wages of skilled mechanics are not high, relatively speaking. We have been guilty at times of printing laments from some of our older readers on the passing of the old "all-round" machinist. If one considers the war-made machine tender who calls himself a machinist and expects a machinist's pay the feeling expressed seems justified, but in view of the training the *real* machinist has gone through and of the work he must be capable of doing, he is not overpaid. Every other possible economy must be effected before wages are reduced to bring down manufacturing costs.

We have mentioned declines in textiles, leather goods and farm products that have gone far deeper than any in the motor field. To compare this condition with that in the machine-tool field seems rather footless, for the speculative nature of raw materials markets sets them far away from one generally so non-speculative as the machinery market.

Another reason why a comparison with raw materials and staples like textiles and leather goods is futile, lies in the advances made in design and construction of modern machine tools over those built in 1914. The potato of this autumn is quite like the potato that flourished before the war, and the cotton sheets on the storekeeper's shelves that arrived last week are indistinguishable from those made six years ago. A good shoe today is no different from a good shoe made in pre-war times but the lathes, planers, shapers and grinding machines of 1914 have been replaced by models with improvements worth far more to the purchaser than the increase in price which may have accompanied their introduction.

Wages are high, materials are up, sales expense is sure to be higher than it has been in recent years, service costs are not diminishing, quality is better than ever. And prices? There is only one answer—they are fair and should be maintained.

Action of Engineering Societies Concerning the F.A.E.S.

THE Board of Directors of the American Institute of Electrical Engineers, at its meeting on Oct. 8, 1920, appointed the following representatives of the Institute on American Engineering Council. The asterisk indicates that the appointment is subject to ratification at the annual meeting in February, 1921: *Comfort A. Adams, Cambridge, Mass.; A. W. Berresford, Milwaukee, Wis.; *H. W. Buck, New York, N. Y.; F. L. Hutchinson, New York, N. Y.; W. A. Layman, St. Louis, Mo.; William McClellan, Philadelphia, Pa.; L. F. Morehouse, New York, N. Y.; L. T. Robinson, Schenectady, N. Y.; *Charles S. Ruffner, New York, N. Y.; L. B. Stillwell, New York, N. Y.; **Calvert Townley, New York, N. Y., *members of Engineering Council of Founder Societies.

The Florida Engineering Society has appointed L. R. McLain as its representative at the first meeting of American Engineering Council, Nov. 18 and 19, 1920.

Additional Members

The following societies have joined the F. A. E. S., bringing the total membership to fourteen: American Society of Agricultural Engineers, Ames, Iowa; Detroit Engineering Society, Detroit, Mich.; Engineering Society of Buffalo, Buffalo, N. Y.; Florida Engineering Society, Gainesville, Fla. (subject to ratification at the annual meeting in February, 1921).

The aggregate membership of the fourteen organizations is 37,233 and they are entitled to 43 representatives on American Engineering Council.

Programs of Other Societies

The following societies to whom has been extended an invitation to become charter members of the Federated American Engineering Societies will consider the question during October and November: American Institute of Architects; American Society of Civil Engineers; Albany Society of Civil Engineers; Associated Engineering Societies of St. Louis; Brooklyn Engineers' Club; Engineers and Architects' Club of Louisville; Engineers' Club of Cincinnati; Engineers' Club of Columbus; Engineers' Club of Philadelphia; Engineers' Club of St. Louis; Engineering Society of Wisconsin; Engineering Society of Western Pennsylvania; Grand Rapids Engineering Society; Iowa Engineering Society; Louisiana Engineering Society; Mohawk Valley Engineers' Club; National Fire Protection Association; Washington Society of Engineers.

The following societies have referred the matter to a special committee for report at an early date: Associated Engineers of Spokane; Boston Society of Civil Engineers; Colorado Society of Engineers; Illinois Society of Engineers; Illuminating Engineering Society (by its Council); Oregon Technical Council; Rochester Engineering Society; Society of Automotive Engineers; Western Society of Engineers.

Unnecessary Finish on Tools

By George H. Henrietta

Many firms engaged in manufacturing a uniform product place a large part of their tool work in jobbing shops and pay for this work on a time and material basis, the usual arrangement being that a certain rate is agreed upon for each hour of time, while patterns, castings, and material are billed at cost, plus 10 per cent to cover expense of handling. The hourly rate varies according to locality, class of work, etc.

This work is mainly jigs, fixtures and similar special single-purpose tools, intended for purely utilitarian purposes, and these tools do not actually require finishing except on such surfaces as function either in their operation or construction. Careful supervision of this feature may result in large savings, for the jobbing shops and the individual workmen therein cannot be held entirely to blame for wanting their product to have a good appearance unless they receive positive instructions covering the case.

The following "Instructions to Toolmakers" are very much to the point. They are appended to tool drawings placed in jobbing shops by an important firm of automobile manufacturers:

INSTRUCTIONS TO TOOLMAKERS

(1) The purpose of this jig or fixture is to produce accurate and interchangeable work and it should be made so that it will do so.

(2) It is not necessary to polish it and files or emery cloth should not be used in its production, except that a file may be used to remove burrs or sharp corners which are likely to damage the hands of the user.

(3) The parts should be machined only where it is necessary for the proper functioning of the jig. The remainder of the jig should show either mill scale on the steel, or casting skin if made from a casting.

(4) The appearance of the jig is of no importance whatever, and any time spent on work which is merely to improve the appearance, is money wasted.

A Question in Factory Management

By A. W. Forbes

On page 375 of *American Machinist* W. Burr Bennett asks a question that has repeatedly come up with us. What shall we do when there is not enough work in one department to keep one man busy? He suggests a nickel-plating department.

Our snagging work is an example of this sort. We have about enough snagging to keep a man busy one hour a day, while anyone familiar with the class of snagging that is done at foundries will recognize that a large part of the snagging must be done where the casting is used. We employ a "Tech" student for this work, and find the method very satisfactory.

In winding electric motors the problem is somewhat different. One man could easily handle all our winding, but what if he should be sick or quit? You cannot teach a winder in a day, and it is impossible to find an experienced winder in our vicinity who is familiar with our class of winding, or if one should be found, it would be necessary to offer special inducements to get him to leave his other job, with problematical results.

We therefore have five persons trained for this work; one machinist and five students. You do not get the speed by this method that would be obtained with a single man at the work, but the additional cost, which is not much, should be considered as insurance.

I would like to call attention to the advantages of technical school students for this class of work. In general it is possible to obtain a greater amount of intelligence with less experience from the students. The result is that they do better work on small, unusual jobs where extreme accuracy is not required, but do not have either the refinements of speed or accuracy that can come only from long training. They also have a characteristic of irregularity which is common to youth; that is they will be doing fine work for several weeks, and then make a mistake so evident that it seems impossible. For about half of our work, I consider students the best solution.

SHOP EQUIPMENT NEWS

-Edited by-
S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

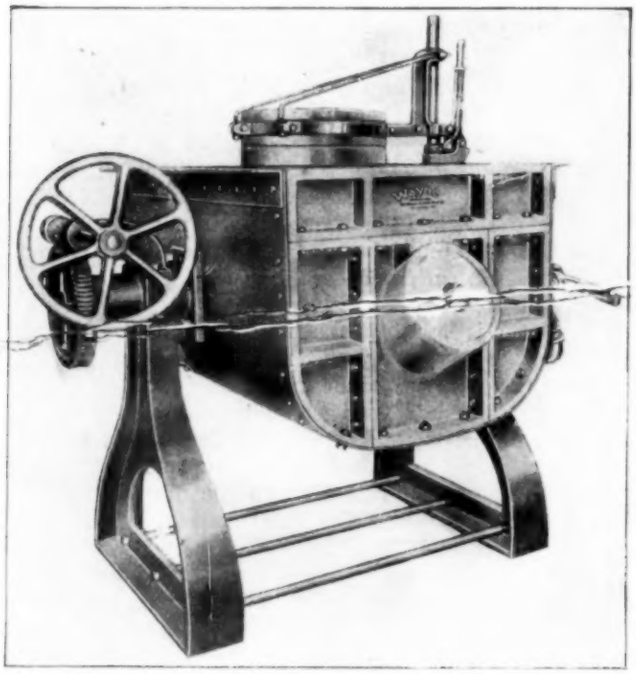
Wayne Tilting Non-Crucible Type Oil-Burning Furnace

The Wayne Oil Tank and Pump Co., Fort Wayne., Ind., builds a line of tilting non-crucible type oil-burning furnaces as shown in the illustration, for melting brass, copper, aluminum and other non-ferrous metals. They were designed with the object of obtaining rapid melting and holding the volatilization losses to a low percentage.

The metal is melted directly on the hearth or bottom of the furnace which is almost flat, a design intended to give a thin layer of metal which will rapidly absorb the heat. Two oil burners are used, both mounted on the same side of the surface. The burners tilt with the furnace so that the flame may be continued while pouring. Air at a pressure of about 1½ lb. and oil at 5 lb. or more pressure is supplied to the burners through piping with swivel joints.

The furnace is charged through a 10-in. hole in the center of the top, which is fitted with a fire-clay cover that can be locked in position or swung to either side for charging. The furnace is tilted by a worm-gear arrangement to insure its being held in any position.

The shell of the furnace is of ¼-in. steel plate with reinforcements of angle iron. The front and back are ribbed gray-iron castings, made in small sections and bolted together. The worm gear for tilting is of cast iron and the worm is machined from steel. The fire-brick lining is 7 in. thick with a layer of insulating material between it and the furnace shell.



WAYNE NO. 3035 TILTING NON-CRUCIBLE TYPE OIL-BURNING FURNACE

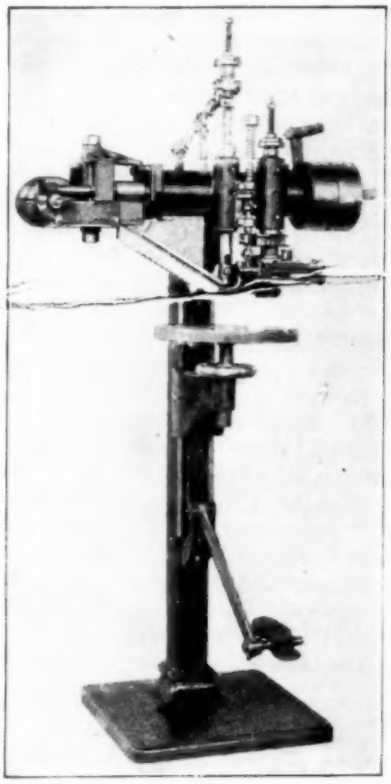
Specifications—Built in two sizes, Nos. 3 and 6. Respective capacities, 350 to 550 and 550 to 800 lb. Average heats per day, 6 to 10 and 5 to 9. Floor space, 56 x 80 in., 66 x 80 in. Height to cover, 51 in. Pipe connections, air, 3 in.; oil, ¾ in. Air volume, 400 and 500 cu.ft. per minute at 1½-lb. pressure. Oil pressure, 5 lb. or more. Shipping weights complete, 5,500 lb. and 6,500 lb.

Reynolds Automatic Magazine-Feed Screw-Driving Machine

The Reynolds Machine Co., Massillon, Ohio, has added to its line the automatic screw-driving machine shown in the illustration herewith. The feature claimed for this machine is that it will not only drive screws of ordinary length, but will also drive very short screws, even those having a length shorter than the diameter of the head.

In operation screws are dumped at random into the magazine where they are automatically arranged in a single row with heads upward and delivered to an inclined track. At the lower end of the track a finger receives a screw and holds it in line with the spindle.

The spindle, carrying a screw-driver bit, is brought down by a treadle, the bit engaging with the slot in the screw head, and both finger and screw are carried downward until the screw engages the work. The finger is then automatically withdrawn allowing the screw to be driven home. The spindle friction can be adjusted so that it will slip when the screw is driven as tight as desired.



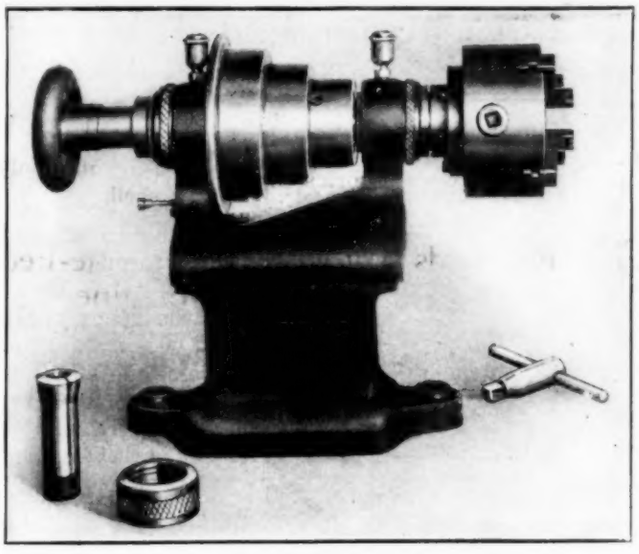
REYNOLDS AUTOMATIC SCREW-DRIVING MACHINE

The table is 12 in. in diameter and can be adjusted on the column to take work up to 15 in. in height and is provided with screw for close adjustment. The treadle is adjustable both for position and resistance to suit the operator. The machine can be belt or motor driven.

Potter Mounted Headstock

The S. A. Potter Tool and Machine Works, 77 East 130th St., New York, N. Y., has placed on the market a headstock mounted for bench use, as shown in the illustration. The device can be employed for filing, polishing and lapping, being adapted to performing speed-lathe work where no tailstock is required.

The headstock is essentially the same as that used on the bench lathes made by the concern. It can be fitted



POTTER MOUNTED HEADSTOCK

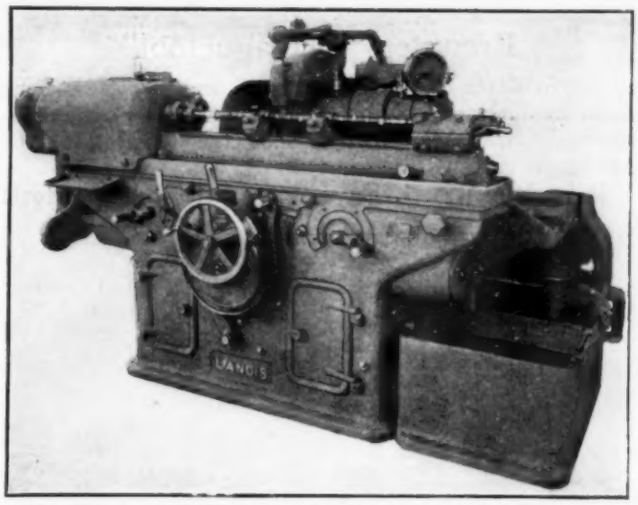
with jaw chucks, spring chucks and lever chuck-openers. The device is driven by belt and fastened to the bench by means of two bolts.

Landis Cam-Grinding Attachment

The illustration shows a cam-grinding attachment mounted on a Landis plain grinding machine. This attachment is a recent product of the Landis Tool Co., Waynesboro, Pa., and is intended for grinding cams for internal-combustion engines.

The master cams are mounted directly on the work spindle inside the headstock. A roller which is stationary in the direction of the cam movement can be selectively brought into engagement with any one of the cams by a lever on top of the headstock, a pointer indicating which one of the cams it is in engagement with. The main body of the attachment carries both the headstock and the tailstock and when one of the cams is in engagement with the stationary roller the whole attachment must move. As the attachment is pivoted to the machine bed the movement must be oscillatory and in unison with the particular cam engaged. The cam and roller are kept in contact by compression springs.

It is claimed that in generating master cams from models, the roller used is of the same diameter as the grinding wheel to be used for reproduction and that with this method together with the pivotal position of

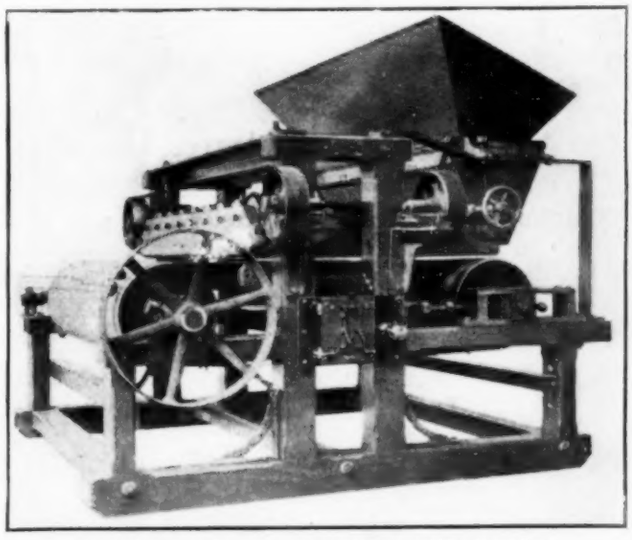


LANDIS CAM-GRINDING ATTACHMENT MOUNTED ON GRINDING MACHINE

the attachment, cams in duplicate of the models can be reproduced with the minimum of error. The live spindle is worm driven. The attachment can be furnished in the following sizes: 5½ x 26½ in., 5½ x 36 in. and 5½ x 52 inches.

Dings Type "B" Magnetic Separator

The Dings Magnetic Separator Co., Milwaukee, Wis., has brought out a Type "B" magnetic separator for granular materials. It is intended for extracting iron from brass and aluminum borings and turnings, and from abrasive materials, rubber buffings and other materials of this nature. The machine has an electro-magnet with poles above two cross-belts which travel above a wide belt containing the materials to be separated. The materials are placed in the hopper from



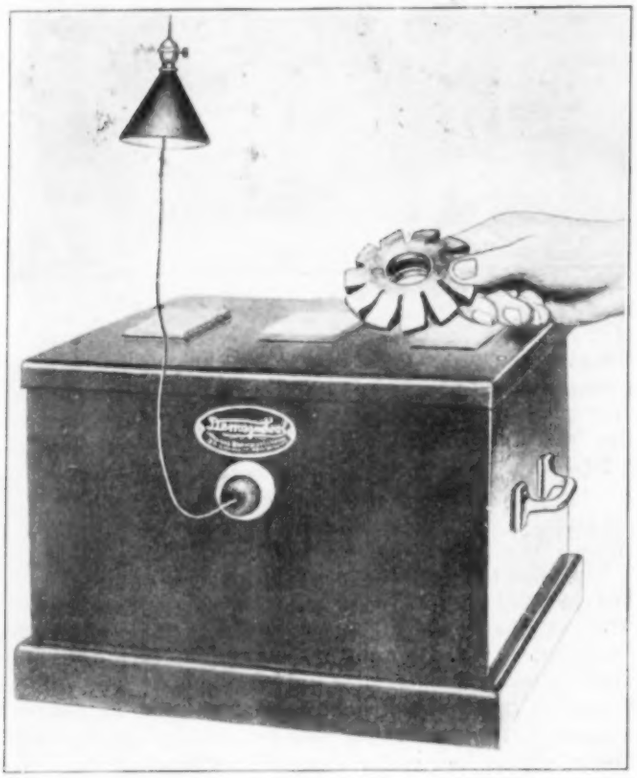
DINGS TYPE "B" MAGNETIC SEPARATOR

which they are distributed evenly on the wide belt. The cross-belts carry the particles which are raised by the magnetic poles to the side of the machine from which they drop into receptacles. These machines are built in five sizes, with conveyor belts from 18 to 60 in. in width. The machine shown in the illustration is the No. 5 size. It is said that the power consumed is very low and that no skilled labor is required.

Brewster "Demagnetool"

The William Brewster Co., 30 Church St., New York City, has recently placed on the market the demagnetizer illustrated herewith under the trade name of "Demagnetool."

It is claimed that this device will demagnetize tools



BREWSTER "DEMAGNETOOL"

to zero instantly and that it is not necessary to rub the tools back and forth on the demagnetizer but only to put them on and take them off.

Warner & Swasey Geared-Head Turret Lathe

The Warner & Swasey Co., Cleveland, Ohio, is placing on the market its Nos. 4 and 6 geared-head turret lathes, designed for machining alloy-steel gear blanks, long drilling operations in the solid, and heavy facing and forming cuts. The No. 6 machine is shown in Fig. 1.

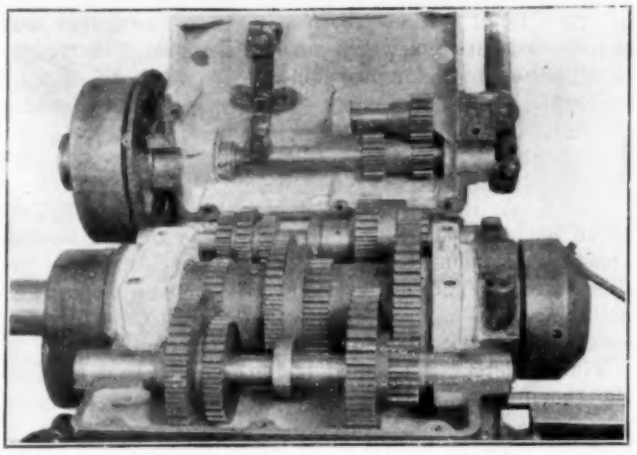


FIG. 2. GEARING IN HEAD OF NO. 6 TURRET LATHE

The geared head is shown in Fig. 2. The gears are of steel, have coarse pitch and wide face and run in an oil bath that also lubricates the bearings. Twelve spindle speeds and reverse are obtainable through two gear sets mounted on the front shaft and one set and the reverse friction clutch mounted on the rear shaft. The No. 4 turret lathe is being equipped with the standard No. 4 cut-off. The No. 6 machine can be equipped with the regular cut-off shown in Fig. 1 or with the "heavy-duty" carriage shown in Fig. 3. A square turret to carry four tools may be substituted for the front toolpost. There are six power cross-feeds obtained through steel change gears which run in oil. The apron gears are also of steel. The turrets are the same as those of the company's standard No. 6 turret lathes and can be equipped with power feed having four changes. The geared-head construction is adaptable to various types of motor drive.

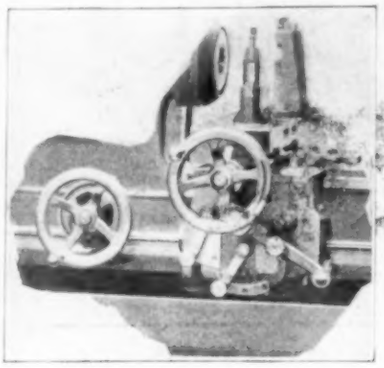


FIG. 3. HEAVY-DUTY CARRIAGE OF NO. 6 TURRET LATHE

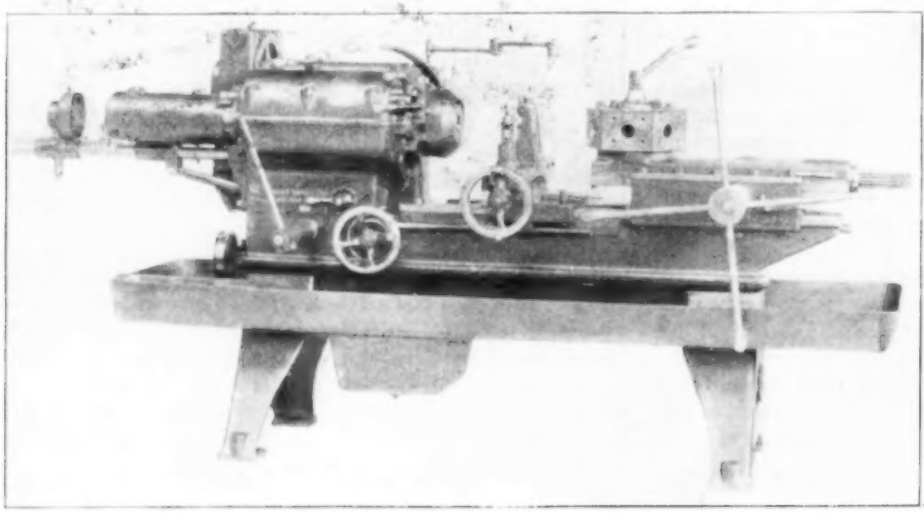


FIG. 1. WARNER & SWASEY NO. 6 GEARED-HEAD TURRET LATHE WITH STANDARD CUT-OFF

Specifications—No. 4, maximum capacities: Round bar stock, diameter, 1½ in. Length turned, 10 in. Swing over bed, 16 in. Swing over cross-slide, 7 in. No. 6, maximum capacities: Round bar stock, diameter, 2¼ in. Length turned, 12 in. Swing over bed, 20½ in. Swing over cross-slide, 9¼ in.

Badger No. 142 Vertical-Spindle Disk-Grinding Machine

The Badger Tool Co., Beloit, Wis., has lately brought out the disk-grinding machine shown in the accompanying illustration.

This machine is of the vertical spindle type, the disk travelling in a horizontal plane. The work to be ground is placed on top of the disk and suitable crossbars or

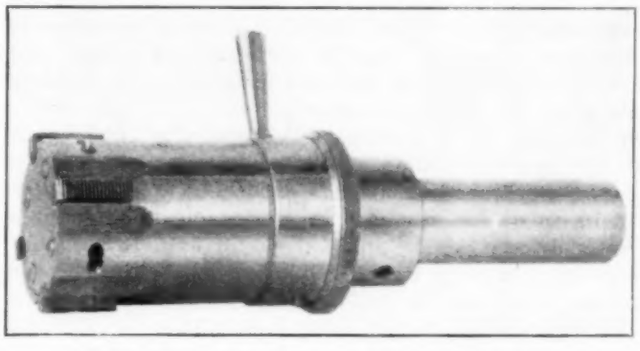
BADGER VERTICAL-SPINDLE DISK-GRINDING MACHINE
Specifications: Disk, 42 in. diameter. Motor, 15 hp. Speed, 600 r.p.m. Complete equipment includes: Steel disk wheel, press for attaching abrasive disks, oil compensator, extra assortment of abrasive disks and an assortment of supplies. Weight 3,000 lb.

stops prevent it from revolving. Pressure against the disk may be provided either by the weight of the work itself or by adding auxiliary weights to the work. A dust channel, accessible by removing the top guard-ring, completely surrounds the outside of the disk. The vertical motor has forced ventilation and means are provided for effective lubrication and exhaustion of dust. The spindle is mounted in radial and thrust ball-bearings, the thrust bearing being adjacent to the disk collar. The machine is built in motor-driven type only.

Rickert-Shafer Collapsible Tap

The Rickert-Shafer Co., Erie, Pa., has recently brought out the collapsing tap illustrated herewith and known as Model P.

The claims made for this tap are: that the action of withdrawing or collapsing the chasers is positive with no liability to stick; that in tapping to a predetermined depth or close to the bottom of a hole, full reliance may be placed on its action as the chasers will collapse at the proper point; that adjustment for size can be made to fractional thousandths of an inch; that the tap will hold to size within the most exacting limits and that the use of sizing hand-taps can be dispensed with. Taps of this type are made in sizes from one to ten inches.

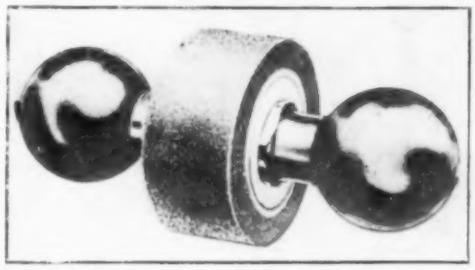


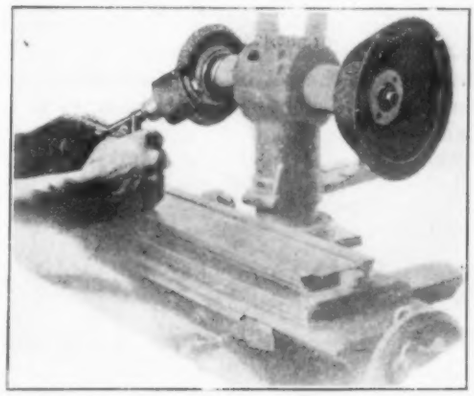
RICKERT-SHAFER MODEL P COLLAPSING TAP

Metcalf Grinding Wheel Dresser

The Oliver Machinery Co., Grand Rapids, Mich., has added to its line the Metcalf grinding wheel dressers illustrated. There are three types, "A," "B" and "C." Types "A" and "C," for hand dressing, are shown by the illustrations. Type "B" is for use with a tool-post.

The dresser consists of a 4 x 1½-in. abrasive wheel revolving freely on its axis. Type "A" (upper) is recommended for truing square, round, bevel or V-edges on wheels 1 in. or less in thickness; type "B" for use with



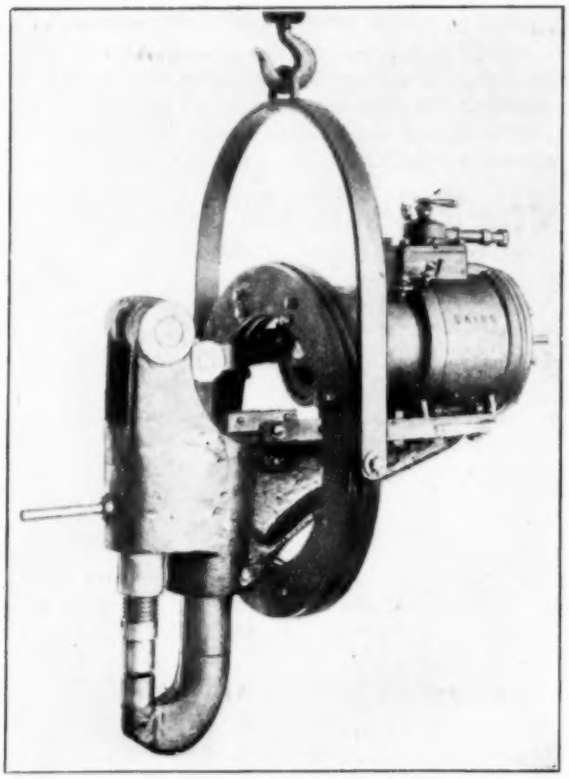


METCALF GRINDING WHEEL DRESSER

cylindrical grinding machines; and type "C" for working in close quarters to true square, round, bevel or V-edges on wheels 1 in. or less in thickness, and the sides on straight or dished wheels. For using type "C" in extremely close quarters smaller sized dressing wheels can be provided.

Baird Stake Riveter for Marine Boiler Flanges

The Baird Pneumatic Tool Co., Kansas City, Mo., has added to its line the riveter illustrated herewith. This riveter is intended for driving rivets between the flanges of either two or three-furnace Scotch marine-boilers but can readily be used in the fabrication of any boiler or tube work where the requirements call for operating equipment having the possibility of adjustment necessary in any of the difficulties met with in such construction. The adjusting screw is of the buttress type and the air cylinders are of the tandem-unit type, both pistons being on the same rod. The delivery of power is

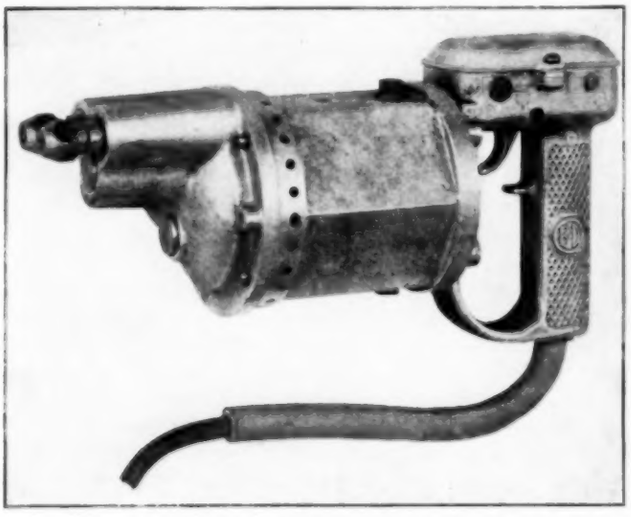


BAIRD STAKE RIVETER FOR MARINE BOILER FLANGES
Specifications: Reach, 5 in. Gap, 12 in. Die adjustment, 3 in. Will drive 1-in. rivets. Air consumption, 4 cu.ft. per drive. Length, 33 in. Height, 40 in. Weight, 750 lb.

at a right angle to the set of the rivet and the toggles are of simple design. The riveter is hung so as to be in balance, and is equipped with a circular frame fastened to the stake. Around this frame and riding on ball bearings is a band fastened to the suspension bail, thus providing for both circular and swinging movements.

Black & Decker Two-Spindle Electric Drill

The two-spindle drill illustrated herewith is a recent production of the Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., and is intended for drilling the holes for automobile curtain fasteners. The handle of the device is like that of an automatic pistol and a pull on the trigger sets both spindles in motion, while a second pull stops them. The motor and the driving gears are said to be simple yet rugged, the gears being made of heat-treated steel. The two spindles, which are only $\frac{3}{4}$ in. from center to center, have special chucks for holding $\frac{1}{4}$-in. drills.



BLACK & DECKER TWO-SPINDLE ELECTRIC DRILL

Oldham Valveless Scaling Tool

The scaling tool shown in the illustration has been brought out by the George Oldham Son & Co., Baltimore, Md. This tool is intended for removing scale from boiler tubes and crown sheets, as well as paint and rust from all metal surfaces.

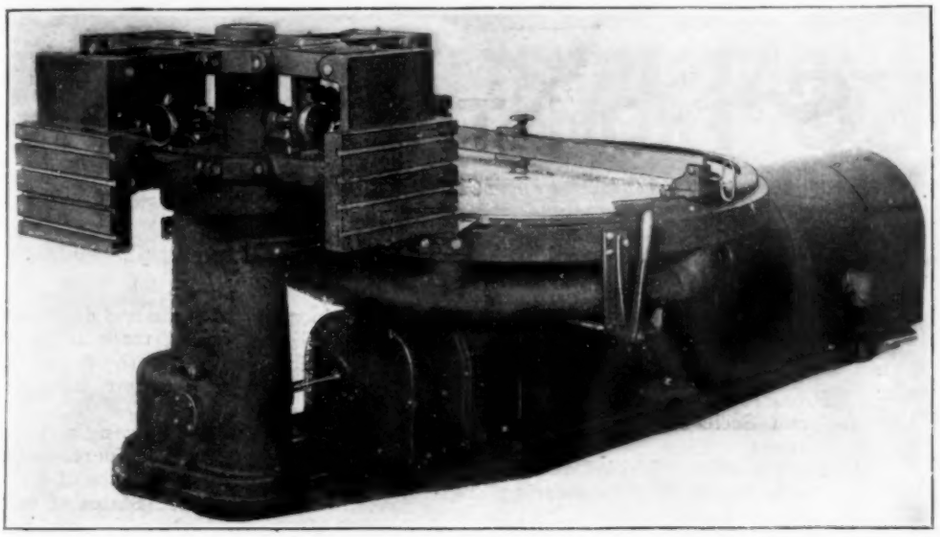
It is claimed that it gives a light rapid blow that removes scale without injury to the surface. It can be fitted with a pipe extension that enables it to reach places which could not be reached otherwise. It measures only $3\frac{1}{2}$ in. overall, weighs $2\frac{1}{2}$ lb., and will operate on any standard air pressure.

OLDHAM VALVELESS SCALING TOOL

Gardner No. 24 Continuous Feed Disk-Grinding Machine

The continuous-feed disk-grinding machine shown in the illustration has been brought out by the Gardner Machine Co., Beloit, Wis. Its purpose is to reduce the amount of labor usually required for the operation of this class of machine and to eliminate the human factor so far as it affects the work done on a disk-grinding machine. It is also intended to obtain great production on account of its constant feed and the employment of the operator's time solely for loading.

The machine consists of a horizontal grinding disk, 53 in. in diameter, and four work-tables rotated by a power-driven vertical shaft. Special fixtures for holding the pieces to be ground may be attached to the tables. The vertical shaft revolves constantly, carrying the work across the grinding disk. The work-table is automatically lowered by a cam until the work rests on the disk. The pressure of the work on the disk



GARDNER CONTINUOUS FEED DISK-GRINDING MACHINE

may be regulated by means of a compression spring, or by regulating the amount of weight in the work fixture. A micrometer screw stop permits grinding to fixed limits. Upon completion of the grinding the work-table is automatically raised before it travels over the edge of the disk to be emptied and loaded.

The feeding mechanism can be arranged so that a work-table will make a complete revolution in 1, 2 or 4 minutes. It is controlled by a friction clutch which enables the operator to stop the feed without stopping the disk. The stand which carries the work-tables can be adjusted over a distance of 6 in. The weight crated is 7,600 lb.

Roberts Multiple-Spindle Fixed-Center Drill Heads

The Roberts Manufacturing Co., 152-6 Brewery St., New Haven, Conn., manufactures a line of multiple-spindle drill heads of the fixed-center type. The illustration shows one of these heads intended for light work. For heavy duty, the case of the head is clamped to the quill of the drilling machine to prevent rotation.

The case is made of cast iron, although it can be made of aluminum, if desired for use on very sensitive machines. Each drill spindle with its driving gear is made of one piece of chrome-nickel steel, the gear having stub teeth. The spindles run in bronze bearings, ball bearings being used to take the end thrust. It is claimed that the drills will break before any damage can occur to the head, since it is amply strong. By using a friction chuck with the head, multiple tapping and stud-setting can be done.

The head can be furnished with any desired number of spindles to hold drills up to 1 in. in diameter.

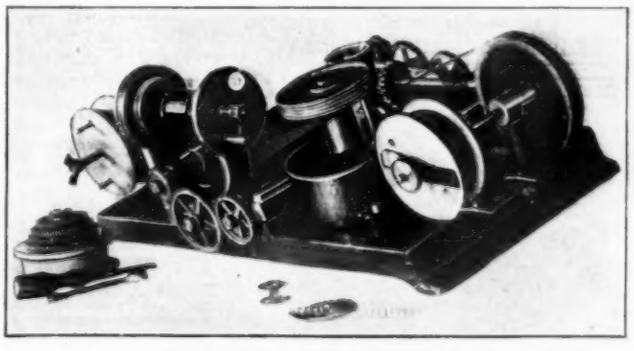
ROBERTS MULTIPLE - SPINDLE FIXED - CENTER DRILL HEAD

"Nemo" Rust Remover

A compound for removing rust and known under the above title is being marketed by Peter A. Frasse & Co., Inc., 417 Canal St., New York. Rusty articles can either be painted with the compound or suspended in a tank containing the compound diluted with water. It is claimed that it will loosen and dissolve rust, grease, oil, dirt, carbon, paint or any other foreign substance irrespective of its age or hardness and that the metal surface will not only not be injured in any way but will be protected from corrosion for a long time after the application. It is also claimed that the compound is safe to use as it will neither burn nor explode

Eisler Coil-Winding Machine

Charles Eisler, 159 Clifton Ave., Newark, N. J., has brought out the winding machine shown in the accompanying illustration. The machine is intended for winding the filament coils for gas-filled incandescent lamps and it is claimed that it is capable of winding coils from 25 to 900 turns per inch for lamps of 15 to 1,000 watts. The mandrels used are from 0.003 to 0.035 in. in



EISLER COIL-WINDING MACHINE

diameter and can be dissolved in acid after completion of the coil. Coils can be wound close or with any desired spacing. The speed of the machine is from 500 to 3,000 r.p.m. according to the size of the filament to be wound.

It is claimed that coils of 5,000 ft. in one length can be wound and that the filament can be electrically heated to a cherry red during the winding.

Iron Production in Southeast

Companies operating furnaces in the Birmingham district report that cancellations have virtually ceased, and that orders still retained will warrant steady operation of the furnaces during the remainder of the present year, and into the early part of 1921. The market continues to experience a lull so far as buying is concerned, but operators feel certain business will experience considerable stimulus immediately after election. October pig iron production wil lexceed that of September.

SPARKS FROM THE WOR

Valentine Francis

Progress on the Safety Code Program

Considerable progress has been made on the comprehensive program of safety codes being undertaken by a large number of organizations under the auspices and rules of procedure of the American Engineering Standards Committee. Following this regular procedure, each code is being formulated by a sectional committee, broadly representative of the interests concerned, and composed primarily of representatives designated by the various bodies interested in the particular code. The sectional committee is organized by one or more bodies designated for the purpose by the American Engineering Standards Committee and known as sponsors.

Sponsorships for the additional safety codes have been arranged as follows:

Construction Work—National Safety Council

Electrical Fire Code — National Fire Protection Association

Electrical Safety Code — Bureau of Standards

Floor Openings, Railways and Toe Boards — National Association of Mutual Casualty Companies

Lighting Code — Illuminating Engineering Society

Lightning Protection—American Institute of Electrical Engineers and the Bureau of Standards

Machine Tools — National Machine Tool Builders' Association and the National Workmen's Compensation Service Bureau

Mechanical Transmission of Power—National Workmen's Compensation Service Bureau, the International Association of Industrial Accident Boards and Commissions, and the American Society of Mechanical Engineers

Sanitation Code, Industrial — U. S. Public Health Service

Stairways, Fire Escapes and Other Exits — National Fire Protection Association

Textiles — National Safety Council and the National Association of Mutual Casualty Companies

The following sponsorships have previously been announced:

Abrasive Wheels — The Grinding Wheel Manufacturers of the United States and Canada, and the International Association of Industrial Accident Boards and Commissions

Foundries—American Foundrymen's Association and the National Founders' Association

Gas Safety Code—Bureau of Standards and the American Gas Association

Head and Eye Protection—Bureau of Standards

Paper and Pulp Mills—National Safety Council

Power Presses — National Safety Council

Pressure Vessels, Non-fired—American Society of Mechanical Engineers

Refrigeration, Mechanical — American Society of Refrigerating Engineers

Woodworking Machinery — International Association of Industrial Accident Boards and Commissions and the National Workmen's Compensation Service Bureau

The *Head and Eye Protection Code* has been completed, and the sponsor, the Bureau of Standards, has submitted the code to the main committee for approval.

The Warner & Swasey Observatory

On Columbus Day, Oct. 12, there was dedicated in Cleveland the observatory presented to the Case School of Applied Science by Messrs. Warner & Swasey, well known to both machine-tool users and to scientists the world over. The new observatory stands on a high spot believed to be the former shore line of Lake Erie, and is provided with the latest and most improved equipment.

Mr. Swasey in a presentation address, recalled to the audience the prominent astronomers with whom his work had brought him in contact, not forgetting the famed makers of objectives, the Clarks, father and sons—and our old friend John Brashear, recently deceased. This recital showed the growth of the observatory as an aid to civilization and the prominent part which the Warner & Swasey Co. has played in its development. Mr. Warner, in a few well chosen remarks, presented the keys of the observatory, which were appropriately received by the president, Charles S. Howe.

This was followed by an extremely interesting address by Dr. W. W. Campbell, director of the Lick Observatory, who showed some of the practical assistance which astronomy rendered to mankind. Professor D. T. Wilson, the astronomer of the Case School, then told of the aims of the observatory and made several practical suggestions as to ways in which it might be made of greater value to the community and to its citizens.

This observatory is but another evidence of the part played by builders of machine tools, as without them, we should have no astronomical equipment.

September Exports $28,000,000 Over August

With increased exports and decreased imports, the balance of trade in favor of the United States for the month of September was nearly four times as great as August.

The August figures, showing a slump in exports and a marked increased in imports, resulting in a balance of trade favorable to the United States of only $65,000,000, caused alarm among protectionists, who feared an influx of cheap foreign goods under existing tariff schedules and consequent injury to American industries.

Statistics for the month of September, however, which were made public Oct. 25 by the Bureau of Foreign and Domestic Commerce, show that in September the favorable balance of trade jumped to $243,000,000. Exports increased $28,000,000 over August, while imports decreased $150,000,000.

While showing an increase over the low mark of August, exports in September were still considerably below the totals of most months of the past year and a half. With the single exception of August, the exports were at a lower ebb in September than in any month since September, 1919. Imports were lower than in any month since August, 1919.

Exports in September, 1920, were valued at $606,000,000, as against $578,000,000 in August and $651,000,000 in July. Exports in September, 1919, when the total was less, with two exceptions, than any month of either 1919 or 1920, amounted to $595,000,000.

Youngstown Pressed Steel Co. Moves to Warren, Ohio

The main office of the Youngstown Pressed Steel Co. is now established in Warren, Ohio, having been moved from Youngstown during the last week of September. It is located in the new factory building which cost approximately one million dollars and covers six acres of floor space. This building embodies the last word in modern design and shows careful attention to those details designed to make it "a place where work is a pleasure," a slogan adopted by the company.

Among the changes in organization are the following: C. A. Morrow, appointed sales manager of pressed steel department, formerly assistant manager, Chicago office of the Sharon Steel Hoop Co.; A. C. Snyder, appointed assistant to C. W. Dickinson, sales manager of fireproofing department, formerly in the Eastern sales department of the Universal Portland Cement Co

LD'S INDUSTRIAL FORGE
News Editor

Estimated Demand for Spark Plugs in 1920

The number of spark plugs required for new equipment and replacement on cars, trucks, tractors, etc., has been calculated with considerable care by the research department of the Class Journal Co. Individual specification sheets of various manufacturers were used to ascertain the number of cylinders in each case. These figures, used in connection with production figures for the past six years and estimated figures for 1920, make it possible to calculate the quantity of spark plugs required with a fair degree of accuracy.

New equipment, spares and replacements required for 1920 production:

Cars and trucks	23,625,000
Motorcycles, tractors, farm light systems, stationary, engines, motor boats and airplanes	3,610,000
	27,235,000

Replacements required for apparatus produced prior to 1920 and now in use:

Cars, trucks, tractors, etc. (See above list)	109,583,928
Exports (including Canada) for replacements	4,808,000
Required to replenish merchandise stocks here and abroad	30,000,000
Total spark plugs required for 1920	171,626,928

—*Automotive Industries.*

A. S. M. E. Organizes Aëronautic Section

In the field of aviation a good deal of co-operative engineering work has been done, standards have been established, details of construction perfected, interchangeability secured. Nevertheless there still exists the real opportunity for promoting in a large way the broad engineering development having to do with the future of aerial navigation regarded as an essentially international science, art and business.

To this end the members of the American Society of Mechanical Engineers interested in aeronautics have organized themselves into a professional section on this subject.

Side by side with the development of the engineering features of aviation, which are obvious to all, a few minds have for some years been looking beyond the details of construction into the realm of international aircraft problems, and have in fact secured for America a reputation for breadth of vision regarding the future of air navigation throughout the world.

Howard E. Coffin, Jesse G. Vincent, Orville Wright, C. F. Kettering, Elmer A. Sperry, James Hartness, John R. Cautley, Lionel S. Marks, Miller R. Hutchison, Charles E. Lucke and Joseph A. Steinmetz, all prominent in the aeronautic field in the war, are among those who have registered in the section.

Railroad Electrification Night at the Engineering Societies Building

The first joint meeting of the Metropolitan Section of the American Society of Mechanical Engineers and the New York Section of the American Institute of Electrical Engineers was held in the main auditorium of the Engineering Societies Building on West 39th St., Oct. 22. The big hall was jammed by members and guests who came to hear the relative merits of steam and electric locomotives. The feeling on both sides was strong and the remarks naturally showed a somewhat partisan tinge. The speakers were well chosen and the result of the debate seemed to be that each side was more convinced that it was right than before.

Four other joint meetings of the two sections have been arranged as follows: On Dec. 3, the "American Power Problem" will be the topic, Frederick Darlington in charge; Jan. 28, 1921, "Marine Electrical Engineering," Alfred E. Waller in charge; March 25, "Industrial Relations," Prof. Walter Rautenstrauch in charge, and April 22, "Engineering Education," Prof. Comfort A. Adams in charge.

Betts-Ingle Hallowe'en Party

Owing to the fact that no picnic of employees was held this summer, the Hallowe'en party and dance given on Oct. 30 was of considerable importance to the employees of the Betts Machine Co. and of the Ingle Machine Co., Rochester, N. Y. (the former concern is the selling organization for the latter, which is a manufacturing one). The party is an annual affair, this being the second one held. The shop organ, "The Tool Post," said with reference to the stunt: "It's gonna be an old-fashioned Hallowe'en affair, with cider, doughnuts, dancing, music and everything. Old Man Dull Care won't have a look-in that evening."

The dining hall of the plant was appropriately decorated with lanterns and pumpkins, the tables being removed to permit of dancing. Masquerade costumes were worn, prizes being awarded for the best. The party was given by the management for the employees in order to promote acquaintance and friendship between the members of the various departments of the plant.

The Situation of the German Machine-Building Industry

A very pessimistic picture of the near future of the German machine-building industry was drawn at the recent annual meeting of the German Machine-Building Association. "The industry has to eliminate all waste of energy, labor and time," said Mr. Becker, general manager of the Breuer, Schumacher & Co. machine-tool works at Koeln-Kalk. "It is impossible," he continued, "to continue working on the lines of pre-war time when labor and material were cheap and the whole world open to German products. The German works cannot keep up, in the future, their present extensive manufacturing program. The future belongs to specialization and standardization."

This is the first time that the German machine builders have been asked to look upon the situation in this light. At all former occasions, the increase of cost of labor and material has been stated to be responsible for the predicaments of the industry. It is evidently recognized now that no improvement can be expected in that direction and this may be responsible for the change of front.

Although there has lately taken place a slight reduction of iron and steel prices, this is merely due to the present business stagnation. As long as the cost of material and labor, expressed in foreign money, is so far below that of foreign countries, the argument that on this account the German industry cannot compete with foreign rivals is not upheld. The German machine-building industry has not made such huge profits during the last export boom as was commonly believed; it is in a bad way now since the business stagnation has set in. It is, however, not commonly recognized that the failure of making profits was chiefly due to the fact that the shops have neglected economy and that the present dull times are to a large degree due to the fact that the works have forgotten how to sell.

The machine builders united at the annual meeting all agreed that the home demand was at present practically nil. A great number of works during the war have built and installed extensions to their shops for which there is no use at present. Under such conditions there is little inclination to buy new equipment.

The export business on which the German industry is now mostly dependent has greatly decreased. New orders are coming in very sparsely. The business in hand mostly dates from contracts made before the depression set in.

Numerous shops have not received a single order since several months. Working hours have been cut down to 32 and 24 hours per week. The shops are compelled to manufacture for stock and those financially unable to do so, have no option but to close down entirely. The number of unemployed workmen is increasing rapidly, making the situation so serious that the government will shortly be compelled to take matters in hand.

Society of Industrial Engineers To Convene in Pittsburgh

The national convention of the S. I. E. will be held at Pittsburgh, Pa., on Nov. 10, 11 and 12. The meetings will be held in Carnegie Music Hall, which has a seating capacity of 2,000. A cordial invitation is extended by the society to every one interested.

The following is a partial list of the topics on the program:

The Need for Industrial Education;
Training Industrial Engineers Within the Organization;
Methods for Training Time Study Men;
College Training for Industrial Engineers;
Educational Training for Business Men;
Analyzing Industrial Educational Requirements;
Training Shop Employees;
Training Foremen;
Training Personnel Administrators as a Solution of the Labor Problem; Illustrated;
The Value of Morale in Industry and Means of Developing It; Illustrated;
Training the Office Force;
Training Managers to Apply Business Principles;
The Part of Psychology and Psychiatry in Industry;
Some New Factors in Industrial Education;
European Industrial Conditions, etc.

During the convention there will be a series of special group luncheons and dinners at the Hotel Schenley for educators, industrial engineers, personnel directors, production managers, cost accountants, etc. Programs may be obtained from the S. I. E. business office, 327 South LaSalle St., Chicago.

New Ships for Southeast Steel Mill Products

The Chickasaw Shipbuilding and Car Co. will launch early in November the sixth 10,000-ton ocean steel freighter built in the company's yards at Mobile, Ala. Fourteen of these ships are to be built for overseas trade. It is probable that all of them will carry on their initial cargo Birmingham steel-mill products. Two of the first five ships built carried steel products from the Birmingham district to Rotterdam, and two others carried similar cargoes to China and Japan. The Montgomery City, the fifth of the ships launched, is now being equipped for its maiden voyage.

Cutting a 44-Inch Riser

Heavy cutting with the oxy-acetylene flame has become so common that today nothing short of a super cut attracts particular notice. A real super cut was made recently in the plant of the National Car Coupler Company at Attica, Ind., when a cutter operating an Oxweld blowpipe tackled a 44-in. (square) steel riser. The cut was rendered more difficult because of the upright position of the riser, which necessitated a horizontal cut. If the riser had been horizontal and the cut vertical the operation would have been much simplified. To offset this difficulty the operator resorted to first cutting the corners of the riser so as to reduce

CUTTING THE 44-INCH RISER

the uncut cross section to a smaller square. This operation was repeated until the remaining stem could be easily cut through. The equipment consisted of the Oxweld cutting blowpipe, Linde oxygen and Prest-O-Lite dissolved acetylene.

In this manner it would appear that there is no limit to the thickness of steel that can be cut with the oxy-acetylene torch, as the operation of slicing off angles can be carried to any desired extent so long as access to the metal with the cutting flame is provided. With the injector type of blowpipe the "reach" of the flame enabled the operator in this instance to carry out the work by simply directing the jet through the initial kerf.

Meeting of the Industrial Cost Association

The Industrial Cost Association (formerly the Industrial Cost Accountants Association) held a meeting in the office of the Westinghouse Air Brake Co. in New York, recently. The following men were elected members of the board of directors: Spencer M. Duty, president, National Paving Brick Manufacturers Association and president, Medal Paving Brick Co., Cleveland, Ohio; W. E. Hundley, auditor, Mesta Machine Co., West Homestead, Pa.; W. H. Moore, secretary, Gulf States Steel Co., Birmingham, Ala.; G. K. Wilson, assistant secretary, Sullivan Machinery Co., Chicago, Ill.

Walter Rautenstrauch, professor mechanical engineering, Columbia University, and director, Brunswick Refrigerator Co., had been elected a member of the board on Aug. 24. The other members are the four officers of the association, M. F. Simmons, president, General Electric Co., Schenectady, N. Y.; C. H. Smith, first vice president, Westinghouse Air Brake Co., Wilmerding, Pa.; Roland H. Zinn, second vice president, Tanner's Council, New York City; A. A. Alles, Jr., secretary-treasurer.

It was decided that the association should immediately organize local sections, giving first attention to those cities and towns in which its present members were located.

The objects of the Association and the requirements for membership are explained by the following extracts from its constitution and by-laws:

(a) To encourage the interest of manufacturers everywhere in accurately determined costs. (b) To standardize accounting and cost terminology; to so far as practicable simplify cost accounting; and to adopt standard governing principles. (c) To educate the members in the complex economic problem of industry; and to develop, improve and extend the use of charts and other forms of statistics that graphically portray cost data of vital importance to management. (d) To assist standardization committees of trade associations in establishing uniform accounting and cost practices, and to encourage the interchange of average cost experiences among manufacturers who are members of trade associations, thereby making possible the elimination of unintelligent competition. (e) To provide by general meetings, and through local sections for the discussion of cost problems and the interchange of ideas; and (f) To act as a clearing house in distributing to all members the development in cost practices to the end that uniformity once established may be maintained

Section 1. Membership in the association shall be limited to executives of industrial corporations, firms, and trade associations; those executives who use cost data, or encourage others in its use; and those who control, or are permanently and actively engaged in the executive supervision of costs accounting of corporations, firms, or trade associations.

Hewes-Phillips Plant Sold at Auction

The entire plant of the Hewes & Phillips Iron Works, manufacturer of machine tools and Corliss type steam engines, was sold at public auction on Oct. 11 and 12, at the factory, Ogden and Orange Sts., Newark, N. J.

Included in the sale with the machine tools and machine-shop equipment was 100 tons of bolts and nuts and all the small tools and attachments carried in stock. Jessops tool steel was sold at 15 cents a pound. Round iron stock brought 70 cents a hundred pounds and square and angle iron, one dollar a hundred pounds. One Bullard engine lathe, 16 x 8 in., brought $85 and other lathes were sold for $175 and upward.

A Farrel Foundry 15-ton air crane went for $550 and an electric crane with the same capacity brought $400.

Reamers, milling cutters, chucks and other milling attachments sold for one-third of current prices.

Fall Meeting of the American Gear Manufacturers' Association

Opinions differ among the members of the American Gear Manufacturers' Association as to the suitability of the Lake Mononk Mountain House for fall conventions. They met at the beautiful Ulster County resort on Oct. 27, 28 and 29. Some were enthusiastic about the magnificient mountain scenery and the gorgeous autumn foliage but there seemed to be more whose pleasure was spoiled by the local prohibition laws against dancing, cigarettes, cards and the demon rum. Conditions for a successful business meeting could hardly have been improved upon as nothing was seen of the sun, and rain kept the members indoors most of the time with nothing to do but attend the sessions.

Papers were read by P. G. Agnew of the American Engineering Standards Committee and Calvin W. Rice of the A. S. M. E. on "Standardization"; by C. L. Collins, II, a past president of the Electric Power Club, on "Industry Organization," and by Christopher Haigh of the General Electric Co. on "Machine Rate Methods of Distributing Expense." They were well received and aroused much instructive discussion. The rest of the business sessions were devoted to reading and discussion of the reports of the various committees and sub-committees.

An informal banquet was served by the hotel staff on Thursday evening and was to have been featured by an address by Chas. W. Woodward, vice president in charge of personnel of the Hydraulic Pressed Steel Co. Mr. Woodward was unable to be present but his absence was more than made up for by the program of informal stunts directed by G. L. Markland, Jr., of the Philadelphia Gear Works.

The next meeting of the association is to be held in Cincinnati. For the benefit of all the members and particularly those who failed to attend this session it was decided to have the secretary issue a bulletin telling of the occurrences at the meeting. The first bulletin is to be followed by others as the occasion warrants.

Taking into consideration the present unsettled business conditions, and the relative inaccessibility of the Mohonk Lake the meeting was well attended. Nearly two-score ladies were also in evidence.

Reports of the following committees were presented: Reports of the Secretary—F. D. Hamlin; Report of the Treasurer—F. D. Hamlin; Report of the Membership Committee—G. L. Markland; Report of Public Policy Committee—H. E. Eberhardt, chairman; Report of Entertainment Committee—C. F. Goedke, chariman; Report of Publicity Committee—J. C. McQuiston, chairman; Report of Legal Committee—J. E. Gleason, chairman; Report of Library Committee, E. W. Baxter, chairman; Report of Labor Committee—J. B. Foote, chairman; Report of A. G. M. A. Sectional Committee of the American Engineering Standards Committee—B. F. Waterman, chairman; Report of the General Standardization Committee—B. F. Waterman, chairman; Spur Gear Commiteee—F. E. Eberhardt, chairman; Bevel and Spiral Bevel Committee—A. C. Gleason, chairman; Committee on Worm Gears and Spirals, J. C. O'Brien, chairman; Inspection Committee—E. J. Frost, chairman; Sprocket Committee—C. R. Weiss, chairman; Hardening and Heat Treating Committees—R. L. Dodge, chairman; Composition Gearing Committee—John Christensen, chairman; Herringbone Gear Committee—A. F. Cooke, chairman; Committee on Gears and Pinions—Electric Railways and Mine—W. H. Phillips, chairman; Keyway Committee—H. J. Eberhardt; Report of Committee on Uniform Cost Accounting—J. H. Dunn, chairman; Report of Commercial Standardization Committee—C. E. Crofoot, chairman.

Situation in German Steel Market

The stagnation of business has considerably eased the situation in the German iron and steel market and has lately resulted in an all-round reduction of iron and steel prices for raw and semi-finished products. Scrap, which was at its highest point in March at 2,100 Marks, is now freely offered at 500 Marks and still the supply overlaps demand.

The prices for semi-finished products, which were at their highest point in May, have now returned to the level of February.

As Germany is now mostly dependent on foreign countries for the supply of iron ore, the prices will naturally move in accordance with the fluctuations of the exchange. The only stabilizing factor in this respect is the scrap which still forms a large part of the furnace supplies. The supply of scrap is by no means exhausted and is considerably helped now by the scrapping of war material which is now taken in hand vigorously. Lately over 500 airship sheds and aero-dromes estimated to contain over 300,000 tons of steel have been designated to be scrapped. There are still huge stores of ammunition, rifles and ordnance in the country which the Reparation Commission will soon put on the scrap market. Consequently the German industry can to some extent draw raw material still from home resources.

The new Ryan-Bohn Foundry at Lansing, Mich., has been completed and was placed in operation on Sept. 27. The president of the company is Edward Ver Linden, who is also president and general manager of the Olds Motor Works. D. J. Ryan is vice president and general manager. Mr. Ryan is also president and general manager of the Allyne-Ryan Foundry Co., Cleveland, and of the D. J. Ryan Foundry Co., Detroit. E. C. Shields, a Lansing attorney, is secretary, and A. P. Vreeland, formerly with the Mitchell Motors, is general superintendent.

Indiana to Start an Industrial Extension School

The first step toward the start of extension work in Indiana industries, similar to that done for the farmers of the state by Purdue University, was taken recently by representatives of Indianapolis manufacturers and university men at a dinner and meeting at the Chamber of Commerce.

W. E. Stone, president of Purdue; Dr. A. A. Potter, dean of the school of engineering, and George H. Shepard, head of the industrial engineering and management department and the instructor of the course to be given here, spoke on the needs of extension work and the ways in which the university could co-operate with the manufacturers. Arrangements were made for the first course, a training school for foremen, which will be established here.

Dr. Stone spoke of the ways in which agriculture in the state has been aided by the combination of teaching, research and extension work, and he stated that all that has been accomplished for agriculture is possible for the other industries of the state. The engineering schools have been brought to a high standard of instruction, Dr. Stone asserted; scientific research was inaugurated by the establishment of the engineering experiment station three years ago, and now Purdue plans to complete the program by establishing extension schools for manufacturers.

The course will cover thirty-one periods, and will be divided under the following heads: "Setting Shop Standards," "The Relation of Product to Plant Efficiency," "Plant Layout," "Shop Planning and Dispatching, or the Routing of Work," "Cost Systems," "Organization," "Fair Deal," "Development of Morale," "Handling Men," "Improvement of Methods," "Incentive System of Wage Payments."

Stanley Zweibel, of the Nordyke & Marmon Co., read letters concerning the work in Wisconsin and Pennsylvania. A discussion followed. W. D. Oakes was in charge of the meeting.

Mack Co. Increases Capital to Expand Factory

At the annual stockholders' meeting of the Mack Manufacturing Co., Ltd., of Houston, Tex., the capital stock was raised from $500,000 to $2,000,000. The extra capital is to be used to build additions and install more equipment in the modern re-enforced concrete plant at Houston, which consists of a large foundry, both steel and gray iron, a well appointed forge shop and a machine shop, where a most up-to-date line of oil field supplies is manufactured. A branch factory, modern in every respect, is also to be built in either northern Texas or Oklahoma, probably in Dallas, Tex., for the manufacture of cable tool equipment. J. O. Mack is president and general manager; H. L. Sadler, secretary; Charles R. Edwards, plant superintendent.

Business Items

The Colburn Machine Tool Co. announces the removal of its entire business from Franklin. Pa., to its new plant, 1038 Ivanhoe Road, Cleveland, Ohio.

The National Ship Supply and Machinery Co., New York, has purchased the plant of the Maryland Shipbuilding Corporation, Sollers Point, Md., from the Emergency Fleet Corporation, which took over the plant shortly after the signing of the armistice. The property includes 51 acres with 2,600 ft. waterfront and four shipways.

The Williams Machine Co., Poultney, Vt., is the name of a new company organized to manufacture special machinery, dies, jigs, etc. The organizers, Robert H., and Russell I. Williams, have had much experience; the former spent 40 years in this line of work, and the latter has been with the Ruggles Machine Co., Poultney, Vt., for 16 years.

The Rutenber Motor Co. which some time ago sold its plant in Marion, Ohio, to the Velie Motor Co., Moline, Ill., announced recently that it had bought the big plant of the American Chain Co. in West Marion and expected to begin operation Oct. 15. The company will manufacture automobile parts and motors. A large force will be employed.

The Latrobe Electric Steel Co., Latrobe, Pa., has opened a warehouse at 1280 Ontario St., Cleveland, Ohio, where a complete stock of Uranium high-speed steel, Mangano non-shrinkable die steel, and carbon and alloy tool steels will be carried.

The National Pressed Steel Co., Massillon, Ohio, has opened offices in the Andrews Building, Dallas, Tex. Its business for the Southwestern district, including Texas, Louisiana, Arkansas, Mississippi and part of Tennessee, will be handled from this branch.

The United Iron Works, Inc., Kansas City, has opened offices in Dallas, Tex., and will move its district branch from Fort Worth to there. O. C. White, district sales manager, will have charge of this branch. This company specializes in structural steel and heavy machinery.

The Walworth Manufacturing Co., South Boston, Mass., has leased the six-story building at Nos. 88-94 Pearl St., Boston, and will remove part of the main office into this building shortly.

Hubbard & Harris, Inc., machinery engineers, with plant at 1047 Broad St., Bridgeport, Conn., have announced a change in name to take effect immediately. The business will now be known as the Hubbard, Harris & Rowell, Inc.

The Buffalo Steam Pump Co., 490 Broadway, Buffalo, N. Y., announces a change in its organization. The newly elected officers are: H. W. Wendt, president; Edgar Wendt, treasurer; H. W. Wendt, Jr., secretary; A. G. Peterson, sales manager, and Robert G. Nye, factory manager.

The Meldrum-Semon-Greiner Co., Inc., and the Lowery & Cance Tool Co., both of Syracuse, N. Y., have been consolidated to form the Meldrum-Semon-Greiner-Lowery Co., or the M-S-G-L Co., Inc., Syracuse, N. Y. The officers are as follows: Mr. Meldrum, president; Mr. Greiner, vice president; Mr. Semon, treasurer, and Mr. Lowery, secretary.

Obituary

Daniel M. Wright

DANIEL M. WRIGHT, president of the Henry & Wright Manufacturing Co., Hartford, Conn., died Oct. 27. He was born in Philadelphia, June 5, 1870.

Mr. Wright was one of the best-known machine-tool men in the country and his gigantic figure was a familiar

DANIEL M. WRIGHT

sight at almost every convention having to do with the welfare of the machine-tool industry. He was at various times first vice president of the National Machine Tool Builders' Association, president of the Hartford Board of Trade, vice president of the Hartford Chamber of Commerce, president of the Russo-American Mercantile Co., director of the Hartford Morris Plow Co., and president of the Hartford branch of the National Metal Trades Association.

THOMAS W. MEACHEM, prominent in the machinery manufacturing world, died at his home in Syracuse, N. Y., recently. Mr. Meachem was the organizer of the New Process Rawhide Co., and later of the Meachem Gear Corporation. [This obituary is reprinted from our Oct. 21 issue, when the name was erroneously given as Homer W. Meachem.]

Personals

J. H. DRURY, treasurer of the Union Twist Drill Co., Athol, Mass., returned Oct. 23 from a six weeks business trip to Europe.

E. E. SAUNIER, 350 Broadway, New York, is the New York representative of the Steel Car Equipment Co., of Delaware.

C. WILLIAM BAYNE, industrial engineer, formerly with the Ford Motor Co., and Timkin Axle Co., of Detroit, Mich.; is now production manager of the F. C. Austin Machinery Corporation, Muskegon, Mich.

H. A. GUTENKUNST, general manager of the Canadian Malleable Iron Co., of Owen Sound, Ont., is leaving shortly for Milwaukee where he will go into business for himself. He will be succeeded by H. H. Todd who has been general superintendent of the Hamilton Stove and Heater Co., at Hamilton, Ont.

A. ARMSTRONG has been appointed manager of the Northern Bolt, Screw and Wire Co., Owen Sound, Ont., Canada.

JOHN E. MCCREHAN, JR., has resigned his position as assistant manager of the production department of the Walworth Manufacturing Co., South Boston, Mass. He plans to enter business for himself in New York City.

R. J. S. PIGGOTT, who has been industrial engineer of the Bridgeport, Conn., Chamber of Commerce for the past few years, has severed his connection with it to accept a position as works manager of the Crosby Steam Guage and Valve Co., Boston, Mass. Mr. Piggott was also consulting engineer for various Bridgeport manufacturing plants while with the Chamber of Commerce and will still continue in this capacity.

ALBERT B. FRITTS, advertising manager of the Norton Co., Worcester, Mass., was elected vice-president of the Industrial Editors' Association of New England, at the annual meeting and dinner held recently in Boston at Young's Hotel.

JOSEPH P. SESSIONS, treasurer of the Sessions Foundry Co., Bristol, Conn., has been elected president of the Bristol, Conn., Trust Co.

ARTHUR W. YEATES has been appointed production manager of the Eastern Works of the Walworth Manufacturing Co., South Boston, Mass. Mr. Yeates was formerly manager of the sales order department in the same plant.

I. R. GREEN, who has just returned from the Far East, where he has been located for the past four years, has taken up his new duties as assistant manager of the export department of the Yale & Towne Manufacturing Co., Stamford, Conn.

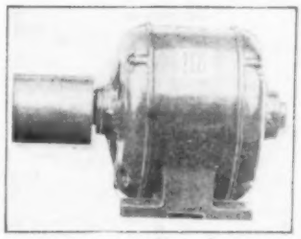
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Motors, "HB"

Hobart Brothers Co., Troy, Ohio

"American Machinist," Oct. 7, 1920

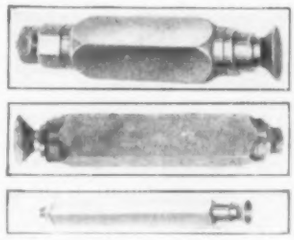


Sizes, from 1 to 10 hp. The d.c. motors are equipped with starting boxes, the 7½- and 10-hp. units having compensators also. All motors have ball bearings and are furnished with base tracks and pulleys. Speed, 1,800 r.p.m. for all sizes. The a.c. motors can be furnished in either 2 or 3 phase and practically any cycle and voltage and the d.c. motors in any voltage. The weights of the different sizes are as follows: 1 hp. a.c. 140 lb., d.c. 180 lb.; 2 hp. a.c. 160 lb., d.c. 200 lb.; 3 hp. a.c. 210 lb., d.c. 250 lb.; 5 hp. a.c. 315 lb., d.c. 340 lb.; 7½ hp. a.c. 590 lb., d.c. 600 lb.; 10 hp. a.c. 650 lb., d.c. 675 lb.

Dressers, Grinding Wheel, Three Styles

Commercial Welding and Machine Co., Worcester, Mass.

"American Machinist," Oct. 7, 1920

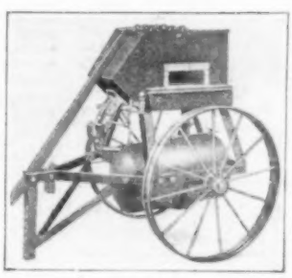


The dresser at the top is equipped with a double ball bearing in the front end and a ball radial and thrust bearing in the rear. Different sizes of cutters can be used. The tool is made in 2- and 2½-in. sizes, the standard length being 6 in. The dresser shown in center is equipped with straight roller bearings and a ball thrust bearing. It is made in two sizes, the casing being either 2 or 2½ in. square. The bottom dresser is small enough to permit its use on small cup and cylinder wheels. The spindle runs in a soft bushing, has a ball end adjustment and ordinarily carries a ¾-in. conical cutter. The casing is ⅝ in. square.

Forges, Rivet, Oil-Fuel, Portable, "No. 18"

Mahr Manufacturing Co., Minneapolis, Minn.

"American Machinist," Oct. 7, 1920



The device is intended for car repair work or for work performed in yards where the forge must be trucked over uneven ground. It is mounted on two large, wide-tread wheels fitted with roller bearings. The burner operates on the vacuum principle, drawing oil from an 18-gal. fuel tank. Either fuel oil or kerosene may be burned, compressed air being employed at a pressure of from 30 to 120 lb. per square inch, the air consumption being 8 cu.ft. of free air per minute. The forge has a capacity of four hundred ⅝ x 3-in. rivets per hour. For boiler shops and for use on level floors, this same type of forge is mounted upon a different style of truck and known as the No. 15 forge.

Drilling Machine, Bench

G. R. Mellon, 380 Wayne St., Jersey City, N. J.

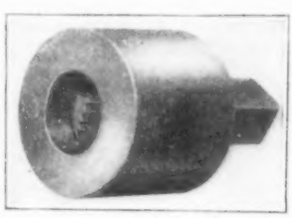
"American Machinist," Oct. 7, 1920

This machine has been designed for strength and stability. Lever feed is provided, the thrust being taken by a bronze and fiber bearing. The chief feature is the monitor table carrying different forms for holding work. The flat table can be easily detached. The fixture makes it possible to readily drill holes centrally in balls and shafts. Specifications: Capacity up to ⅝-in. drills. Spindle to table, maximum, 11 in. Spindle, travel, 3½ in.; diameter, ⅞ in.; hole, No. 1 Morse taper. Diameter of table, 8 in. Number of speeds, 3. Extreme height, 40 in. Net weight, 125 lb.

Chuck, Stay-Bolt, Reversible, "Perfection"

Tom Brown & Co., 800 Great Northern Building, Chicago, Ill.

"American Machinist," Oct. 7, 1920



The chuck grips round stay-bolts, either threaded or blank, and saves squaring the ends. It will drive in either direction, so that when necessary it can be used for backing out the bolts. The chuck can be furnished with either a square or Morse taper shank. It is made in three sizes, each size fitting three different sizes of bolts. Specifications: Built in three sizes: No. 1 for bolts from ¾ to ⅞ in.; No. 2 from ⅞ to 1⅛ in.; No. 3 from 1¼ to 1½ in. Either square shank or Morse No. 3 taper furnished as ordered.

Oil Heater, "G-R"

Griscom-Russell Co., 90 West St., New York.

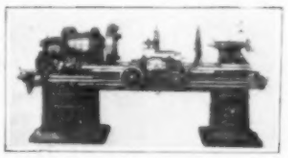
"American Machinist," Oct. 7, 1920

This device is intended for pre-heating fuel oil before it goes to the burners, so as to insure complete atomization and perfect combustion. The oil is pumped through the tubes, making three passes between the inlet and the outlet, and high-pressure steam in the shell serves as the heating medium. The shell is constructed of wrought steel welded to the steel tube sheets, and the heads are cast iron. The tubes are of seamless drawn steel expanded into the sheets at both ends. Perforated steel baffles are placed in the steam space. If desired, the tubes can be fitted with agitators for increasing the oil velocity and the rate of heat transfer. No fittings are required. The heater is made in a wide range of sizes, the weights varying from 150 to 3,100 lb.

Lathe, Cone-head

Heidenreich & Harbeck, Hamburg, Germany

"American Machinist," Oct. 14, 1920

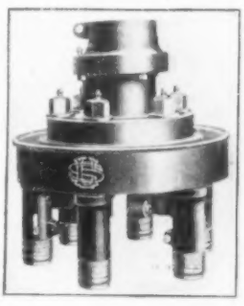


Double back gears are used in this machine, giving nine forward spindle speeds. The lead screw is used only for thread cutting, the feed rod governing ordinary longitudinal and transverse motion of the carriage. In addition a reversing shaft permits either the lead screw or feed rod to be operated in the reverse direction. Built-in change gears provide fifty feed steps without the removal of a gear. These gears are designed to permit standard English threads to be cut. Feeds are operated through friction clutches in the rear apron and cannot be engaged simultaneously. The compound rest is graduated and the saddle is extra long.

Drill Heads, Multiple-Spindle, Adjustable Center

United States Drill Head Co., Cincinnati, Ohio.

"American Machinist," Oct. 14, 1920



This head is made in five sizes: No. 1 drills on circles from 2 to 5 in. in diameter; No. 2 from 2¾ to 7 in.; No. 3 from 4⅞ to 11⅝ in.; No. 3-A from 8 to 18 in.; No. 4, special, for drilling pipe fittings and flanges. The head is clamped to the quill of the drilling machine; it may be driven by either a taper shank or a key in the drift slot in the spindle. The drill spindles can be readily attached or removed, only one locking nut being used to hold each spindle. The spindles are provided with ball-thrust bearings and have adjustment for end wear. They are geared with a speed ratio, when compared with the driving spindle, of about 3½ to 1. Special sizes can be furnished upon order.

Clip, paste on 3 x 5-in. cards and file as desired

New Publications

The Locomotive Up To Date. By Charles McShane. Eight hundred ninety-three 6 x 8¾-in. pages, 378 illustrations. Bound in black cloth boards. Published by Griffin & Winters, Chicago.

This is a revised edition of the book first issued in 1899. The new matter brings it up to date, and together with the old, forms a book that covers the field in a way to make it valuable as a reference and study book for the practical railroad man and student. Plain, common-sense language is used which is readily understandable to anyone who can read English. Special articles were prepared for the book by experts of the American Locomotive Co., Baldwin Locomotive Works, Westinghouse Air Brake Co. and others. A 22-page, cross-reference index makes it easy to find any subject treated. The various divisions deal with a history of the locomotive, locomotive valves, the Allen slide valve, balanced valves, other valve types, valve gears, link motions, shop practice regarding link motion, valve setting, accidents to locomotives, power reverse gears, boilers, stokers, boiler fittings, injectors, lubricators, pop valves, gages, whistles, bell ringers, indicators, electric locomotives, machine-shop practice and a miscellaneous collection of pointers.

Blueprint Reading. By E. M. Wyatt. Eighty-six 6 x 9-in. pages, 29 illustrations. Bound in blue cloth boards. Published by the Bruce Publishing Co., Milwaukee, Wis.

For the shop man who does not read blueprints easily, for the apprentice and the student, this little book fills a real need. It is just long enough to be clear. The chapters are: Introduction, Kinds of Drawings, The Theory of Orthographic Projection, Meaning of Various Kinds of Lines, Foreshortened Lines—Inclined Surfaces—Auxiliary Projection, Scale Drawing—Dimensions, Breaks—Representing Drawings at Broken, Sections, Bolts—Screw Threads — Machining or Finish, Rivets — Structural Steel, Architectural Conventions, Study of a Set of House Plans, Study of the Bench Grinder.

Industrial Housing. By Morris Knowles. Four hundred eight 6 x 9-in. pages, 54 illustrations. Bound in dark blue cloth boards. Published by the McGraw-Hill Book Co., 239 West 39th St., New York.

The author of this book has had wide experience in the work of which he writes, and for this reason the book is especially valuable. He was supervising engineer at Camp Meade, Maryland, and also at Camp McClellan, Alabama. He also served as chief engineer of the passenger transportation and housing division, Emergency Fleet Corporation, United States Shipping board. He is director of municipal and sanitary engineering, University of Pittsburgh.

The book deals extensively with the building of homes on a community basis, takes up the problems of appropriate planning of streets, blocks and lots, and then goes into the subjects of parks and recreation facilities. Further along the utilities, such as drainage, sewerage, water supply, gas, electricity, transit or transportation, health, sanitation and other subjects are discussed, as well as the actual plannng and building of houses. The chapter headings are: Historical Review, Fundamental Preliminary Considerations, Selection of Site, Development of the Town Plan, Streets and Pavements, Water Supply, Sewerage and Drainage, Collection and Disposal of Town Wastes, Gas and Electric Service, Houses for Families, Buildings Other Than Houses, Administration and Supervision of Construction, Management of Industrial Towns.

DOMESTIC EXPORTS FROM THE UNITED STATES BY COUNTRIES, DURING AUGUST, 1920

METAL-WORKING MACHINERY

Countries	Lathes	Other Machine Tools	Sharpening and Grinding Machines	All Other
Belgium	$9,355	$24,989	$8,958	$74,590
Czechoslovakia	.....	.....	.....	1,181
Denmark	18,522	16,476	5,677	2,308
France	7,660	155,222	6,386	90,521
Greece	4,040	2,344	.....	.....
Italy	1,999	63,514	24,726	54,456
Netherlands	.....	1,895	63	1,742
Norway	323	553	2,741	2,926
Portugal	1,430	556	332	460
Roumania	11,370	644	.....	19,034
Spain	4,054	10,851	2,436	12,728
Sweden	3,564	6,021	69	2,983
Switzerland	.....	9,377	1,214	193
Turkey in Europe	14,534	164	.....	.....
England	144,471	224,232	104,364	366,095
Scotland	11,068	5,219	504	4,950
Ireland	18,035	.....	.....	4,944
Canada	39,184	186,456	39,094	262,888
Costa Rica	.....	5,935	.....	.....
Guatemala	.....	.....	.....	68
Honduras	.....	.....	.....	245
Nicaragua	500	.....	.....	.....
Panama	7,057	430	15	.....
Salvador	595	.....	7	19
Mexico	4,600	3,579	4,324	18,979
Newfoundland and Labrador	.....	202	114	.....
Trinidad and Tobago	.....	216	38	.....
Cuba	8,068	41,208	14,874	23,420
Virgin Islands of U. S.	.....	.....	.....	46
Haiti	.....	538	15	.....
Argentina	10,003	10,965	.....	5,601
Brazil	19,743	4,420	2,443	7,122
Chile	2,452	2,106	1,879	3,596
Colombia	1,767	5,960	134	3,165
Ecuador	2,841	.....	117	.....
Peru	2,309	941	511	652
Uruguay	150	599	.....	.....
Venezuela	.....	3,038	.....	.....
China	15,092	3,151	796	14,854
British India	6,701	50,527	3,096	67,557
Straits Settlements	2,384	17,567	.....	210
Dutch East Indies	20,501	29,141	714	1,312
French Indo China	.....	.....	929	.....
Hongkong	2,700	580	270	6,230
Japan	9,728	58,000	46,553	176,260
Siam	.....	.....	.....	479
Turkey in Asia	1,372	.....	.....	.....
Australia	3,219	9,094	2,378	2,729
New Zealand	.....	2,166	.....	1,160
Philippine Islands	.....	1,308	224	853
British South Africa	1,662	10,870	1,560	4,514
British East Africa	.....	.....	118	.....
Madagascar	1,025	.....	.....	.....
Portuguese Africa	.....	85	122	1,708
Egypt	526	1,108	1,069	.....
Total	$414,604	$972,247	$278,864	$1,242,778

Trade Catalogs

Broaching Machines. The Connecticut Broach and Machine Co., New London, Conn. Bulletin No. 1, eight pages of data on the latest models of broaching machines put out by this company. Several useful tables on spline fitting are provided.

Tools and Toolholders. Armstrong Bros. Tool Co., Chicago, Ill. Catalog B-20, one hundred forty-three 4 x 6-in. pages. A complete list of the many types of Armstrong products, including tools, toolholders, rachet drills, drop-forged wrenches, clamps, lathe dogs and tool cabinets. Illustrations of all types and price lists are also given.

Derringer Combination Toolholder. M. H. Derringer, 3133 N. 8th St., Philadelphia, Pa. Circular describing this latest "All-in-One" fixture which is said to take the place of boring toolholder and a spring toolholder.

Stewart Furnaces. Chicago Flexible Shaft Co., Chicago, Ill. Circulars illustrating and describing the latest additions to the "Stewart" type of heat-treating and annealing furnaces. Several new models are introduced.

Nonpareil Insulating Brick. Armstrong Cork Co., Pittsburgh, Pa. A 72-page catalog, beautifully bound and illustrated, containing a wealth of valuable information on high temperature, industrial equipment, such as boilers, furnaces, stills, hot blast stoves, kilns, etc. Formulas, tables and specifications concerning the use of fire brick in these appliances are also given.

Chain Hoists and Travelers. Edwin Harrington, Son & Co., Philadelphia, Pa. Catalog "L," sixty, 6 x 9-in. pages containing full descriptions, price lists and illustrations of chain hoists, screw and differential hoists, travelers, overhead track equipment, traveling cranes, shock springs and suspension scales.

Cincinnati Acme Efficiency. The Acme Machine Tool Co., Cincinnati, Ohio. Volume 1, a new thirty-page catalog covering the more recent developments of Acme products, flat turret lathes, screw machines and turret lathes. Each of these types is fully described and illustrated, and specifications and working details are furnished.

"Multi-Cuttings," R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Catalog, thirty-four 5½ x 8-in. pages, describing the latest models of multi-cut lathes produced by this company. Full specifications, illustrated by half-tones and line cuts, are given for each machine.

Cost Cutting Tools. McCrosky Tool Corporation, Meadville, Pa. Catalog, No. 7, sixty 9 x 6-in. pages, illustrating and describing the various McCrosky products including super-reamers, quick change chucks and collets, turret attachments for lathes and universal lamp brackets.

A. B. C's. of Refrigeration. Technical Products Co., Inc., 501 Fifth Ave., New York City. Circular describing the high-speed vertical single-acting ring plate valve compressor.

Forthcoming Meetings

The National Machine Tool Builders' Association will hold its 19th annual Fall convention at the Hotel Astor, New York City, on Thursday and Friday, Nov. 11 and 12, 1920. C. Wood Walter, care of the association's offices at Worcester, Mass., is secretary.

The National Founders Association will hold its twenty-fourth annual convention at the Hotel Astor on Nov. 17 and 18, 1920. J. M. Taylor, care of the Association, 90 West St., New York, is secretary.

The Federated American Engineering Societies will hold its first meeting at the Hotel New Willard, Washington, D. C., on Nov. 18 to 20 inclusive.

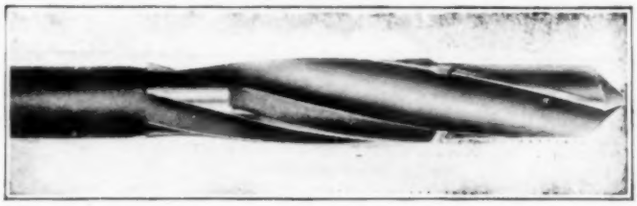
The 1920 annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York City, from Dec. 7 to Dec. 10.

The Society of Automotive Engineers will hold its annual meeting on Jan. 11 to 13 inclusive at New York.

Condensed-Clipping Index of Equipment

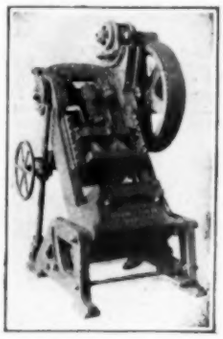
Patented Aug. 20, 1918

Drill and Reamer, Combination
Fastfeed Drill and Tool Corporation, Toledo, Ohio.
"American Machinist," Oct. 14, 1920



This tool is intended for use with drill jigs, so as to drill and ream at one operation. The reamer section is 0.010 to 0.015 in. larger in diameter than the drill. It has four blades, two being formed on the continuation of each land of the drill. The reamer blades can be sharpened from the front edge, the same as with any solid reamer. The standard reamer diameters vary from ¼ to 1½ in. Either straight or taper shanks of any size can be furnished, the Morse taper being standard. Other sizes can be furnished.

Press, Straight-Column, Inclinable, No. 54 Special
Toledo Machine and Tool Co., Toledo, Ohio
"American Machinist," Oct. 14, 1920

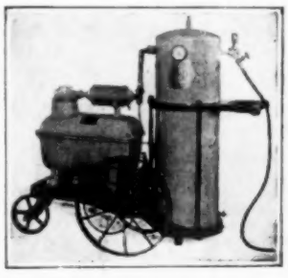


The motor of this machine is always in a vertical position and the pinion always in mesh no matter what the inclination of the press. Specifications: Weight as shown, 6,500 lb. Bed, 24 x 23 in. Bottom of ram, 21 x 19½ in. Opening in bed, 12 x 12 in. Distance between housings, 24 in. Stroke, 2 in. Distance from bed to ram, stroke down and adjustment up, 13 in. Thickness of bolster, 3 in. The press is also built with the frame arched from front to rear to allow a 14-in. opening in the housings to permit of feeding stock sidewise.

Separator, Moisture, for Air Lines
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.
"American Machinist," Oct. 14, 1920

This separator is used for separating moisture and dirt from compressed air, especially the air used by pneumatic tools. The air enters the separator through two pipes and strikes the inside wall or casing tangentially, causing it to revolve rapidly. Centrifugal force throws the entrained moisture and dirt to the walls, on which they descend to the bottom of the tank, while the cleaned air passes on to the pipe line. A drain is provided at the base for removing the accumulation of water and dirt. Built in two sizes. Respective capacities, 150 and 400 cu.ft. of air per minute. Face of gage, 3 in. in diameter. Height, including gage, 31 and 47 in. Diameter of base, 8½ and 12½ in.

Air Compressor Outfit, Portable
Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md.
"American Machinist," Oct. 14, 1920

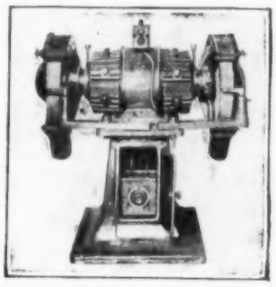


This outfit consists of the firm's No. 46 electric compressor and a 40-gal. air reservoir mounted on a 3-wheel carriage. An automatic switch starts the compressor when the tank pressure drops below 160 lb. and stops it when the pressure reaches 200 lb. An automatic unloader is provided with the switch. The compressor is rated to have a volumetric capacity of 6 cu.ft. of free air per minute and a pressure capacity of 200 lb. The pressure in the reducing valve can be adjusted to give a working pressure of 40 to 80 lb. The outfit is supplied for 110- or 220-volt direct current or 110- or 220-volt, 2-phase or 3-phase, 60-cycle alternating current.

Attachment, Drilling, Angle for Milling Machines
Purves Manufacturing Co., 408 South Franklin St., Syracuse, N. Y.
"American Machinist," Oct. 14, 1920

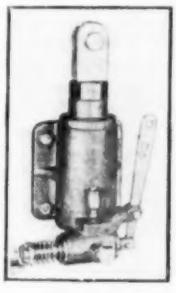
The device is shown mounted on a universal milling attachment fitted on a horizontal-spindle knee-type milling machine, the attachment being set at the angle desired. The work is placed on the table in the ordinary manner so that no angular fixture is required. The drill is fed directly by the hand lever of the attachment. Since the operator can thus feel the pressure of the feed, breakage of the drill is not apt to occur. The position of the feeding lever can be easily changed, so as to accommodate any shape of work. A stop is provided, so that it is possible to drill a number of holes to the same depth.

Grinding Machine, Tool, Self-Contained, Motor-Driven
United States Tool Co., Cincinnati, Ohio
"American Machinist," Oct. 14, 1920



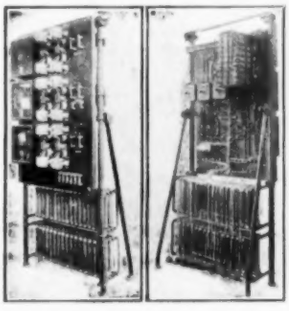
Ease of starting and total inclosure of the motor and control apparatus are features claimed by the maker. The machine is equipped with a 5-hp. shunt-wound, adjustable-speed Westinghouse motor running at from 1,120 to 1,600 r.p.m. on 230-volt direct current. The push button controls a type "C" Westinghouse starter, equipped with a speed-adjusting rheostat and located in the base of the machine. It is mounted on the top of the motor so that the workmen will not accidentally start the motor.

Trip, Pneumatic, Power Press, "Perfection" "Lovejoy"
Tom Brown & Co., 800 Great Northern Bldg., Chicago, Ill.
"American Machinist," Oct. 14, 1920



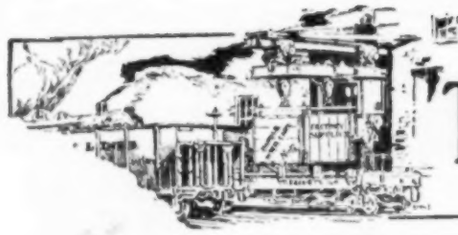
This device eliminates the difficulty of reaching for the foot- or hand-trip lever while standing at the front of a power press balancing a large steel plate. It consists of a working cylinder and valve, and is bolted to the side of the machine so that the coupling on the end of its piston can be attached to the trip lever. The air valve can be operated by a jerk of a cord. This admits air to the cylinder, raises the piston, and operates the trip mechanism of the machine. Two springs quickly return the valve and piston to their idle positions.

Regulator, Furnace, Electric-Arc
Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.
"American Machinist," Oct. 14, 1920



Among the claims made for this regulator are: High electrode operating speed and close precision of regulation with absolute freedom from "hunting"; ability to incorporate high speed with a narrow current zone, due to the fact that the electrode speed tapers from full to zero as the regulated current approaches its normal value. With small variations in current the speed is slow enough to prevent continuous breaking of the arc and, at the same time, when the solid metal begins to cave into the pools of molten metal under the electrodes, sufficient speed is available to permit the regulator to extricate the electrodes before the time relay allows the breaker to trip.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$46.50	$30.55
Northern Basic	51.30	29.55
Southern Ohio No. 2	48.50	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	57.12	32.40
Southern No. 2 (Silicon 2.25 to 2.75)	52.10	35.20
BIRMINGHAM		
No. 2 Foundry	42.00@45.00	29.25
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	51.25	29.00-30.00
Virginia No. 2	50.00*	33.10
Basic	51.00†	26.75
Grey Forge	48.00*	26.75
CHICAGO		
No. 2 Foundry local	47.00	26.75
No. 2 Foundry, Southern	48.67	28.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	49.56	28.15
Basic	48.96	27.15
Bessemer	51.96	29.35

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.30	$4.58	$3.47	$3.44	$3.37	$4.08	$3.47
Soft steel bars	4.75	4.73	3.37	3.84	3.27	3.98	3.37
Soft steel bar shapes	4.75	4.73	3.37	3.84	3.27	3.98	3.37
Soft steel bands	6.43	6.43	4.07	6.25	...	...	...
Plates, ¼ to 1 in. thick	4.50	4.78	3.67	3.64	3.57	4.28	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.77
Warehouse, New York	4.75	3.32
Warehouse, Cleveland	3.52	3.27
Warehouse, Chicago	4.12	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-7.00	7.00@8.00	4.57	6.75	7.13
No. 12	3.60-7.05	7.05@8.05	4.62	6.80	7.18
No. 14	3.65-7.10	7.10@8.10	4.67	7.35	7.23
No. 16	3.75-7.20	7.20@8.20	4.77	7.45	7.33
Black					
Nos. 18 and 20	4.20-6.20	8.40@9.80	5.30	8.30	7.90
Nos. 22 and 24	4.25-6.25	8.45@9.85	5.35	8.35	7.95
No. 26	4.30-6.30	8.50@9.90	5.40	8.40	8.00
No. 28	4.35-6.35	8.60@10.00	5.50	8.50	8.10
Galvanized					
No. 10	4.70-8.00	8.90@11.00	5.75	8.50	8.25
No. 12	4.80-8.10	9.00@11.00	5.85	8.60	8.30
No. 14	4.80-8.10	9.00@11.10	5.85	8.60	8.45
Nos. 18 and 20	5.10-8.40	9.25@11.40	6.15	8.90	8.75
Nos. 22 and 24	5.25-8.55	9.40@11.55	6.30	9.05	9.15
No. 26	5.40-8.70	9.55@11.70	6.45	9.20	9.30
No. 28	5.70-9.00	9.85@12.00	6.75	9.50	9.60

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled.

Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.36	$5.90	$5.50
Flats, square and hexagons, per 100 lb. base	6.86	6.40	6.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

NICKEL AND MONEL METAL—Base prices in cents per pound F.O.B. Bayonne, N. J.

Nickel	
Ingot and shot	43
Electrolytic	45

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold rolled rods (base)	50
Sheet bars	40	Hot rolled sheets (base)	55
Special Nickel and Alloys			
Malleable nickel ingots			45
Malleable nickel sheet bars			47
Hot rolled rods, Grades "A" and "C" (base)			60
Cold drawn rods, grades "A" and "C" (base)			72
Copper nickel ingots			42
Hot rolled copper nickel rods (base)			52
Manganese nickel hot rolled (base) rods "D" — low manganese			64
Manganese nickel hot rolled (base) rods "D"— high manganese			67

Domestic Welding Material (Swedish Analysis)—Welding wire in 100-lb lots sells as follows, f. o. b. New York: ⅜, 8½c. per lb.; ½, 8c.; ⅝ to ¼, 7½c. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.15
Spring steel (light)	10.00	11.00	12.25
Coppered Bessemer rods	9.00	8.00	6.85
Hoop steel	6.68	6.50	5.43
Cold-rolled strip steel	12.50	8.25	11.00
Floor plates	6.91	6.00	6.88

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card:

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
¼ to 3	54-57½%	41½-44%	⅜	15½-25½%	+1½-11%
			½	19½-29½%	1½-11%
			¼ to 1¼	24½-34½%	8 -18½%

LAP WELD

2	47 -50½%	34½-38%	1¼		
2½ to 6	50 -53½%	37½-41%	1½		
7 to 12	47 -50½%	33½-37%	2	20½-28½%	6½-14½%
13 to 14	37½-41 %		4½ to 6	22½-30½%	9½-17½%
15	35 -38½%		2½ to 4	22½-30½%	9½-17½%
			7 to 12	19½-27½%	6½-14½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

¾ to 1¼	52 -55½%	39½-43%	¼ to 1½	24½-34½% 9½-19½%
2 to 3	53 -56½%	40½-44%		

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45 -48½%	33½-37%	1¼		
2½ to 4	48 -51½%	36½-40%	1½		
4½ to 6	47 -50½%	35½-39%	2	21½-29½%	8½-16½%
7 to 8	43 -46½%	29½-33%	2½ to 4	23½-31½%	11½-19½%
9 to 12	38 -41½%	24½-28%	4½ to 6	22½-30½%	10½-18½%
			7 to 8	14½-22½%	2½-10½%
			9 to 12	9½-17½%	5½-+2½%

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
¾ to 3 in. steel butt welded	38%	22%	39%	30%	54% 40%	40½@30%
2½ to 6 in. steel lap welded	33%	18%	41%	26%	50@40%	37½@27½%

Malleable fittings. Classes B and C, banded, from New York stock sell at plus 45%. Cast iron, standard sizes, plus 5%.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	15.50	18.50	22.50
Tin in 5-ton lots	42.00	44.50	56.50
Lead	8.00	8.50	6.25
Zinc	8.00	8.50	7.60
ST. LOUIS			
Lead	7.25	8.00	6.00
Zinc	7.50@7.70	7.70@8.05	7.15

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

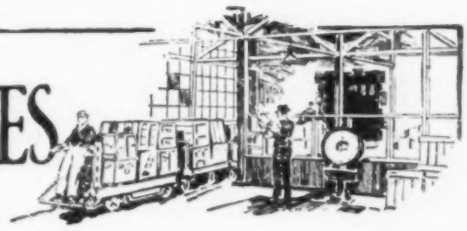
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	25.50	29.50	33.50	30.00	35.50	36.00	36.50
Copper wire (carload lots)	31.25	31.25	30.75	26.00	30.50	29.00	26.00
Brass sheets	28.50	28.50	32.00	30.00	33.00	27.00	28.00
Brass pipe	28.00	33.00	36.00	32.00	39.00	34.00	37.00
Solder (half and half) (case lots)	35.00	35.00	45.00	29.50	41.00	38.00	38.50

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	25.00	24.00
New York	27.00	28.00@29.75
Cleveland	26.00	29.00
Chicago	30.00	27.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound are f.o.b. mill—less 8% for carload lots..... 12.50

	Warehouse			
	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.30	12.50	14.70	13.00
New York	14.00	11.50	14.50	12.50
Chicago	14.50	16.50	14.95	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.25	9.50
Chicago	7.50	9.75
Cleveland	8.50	9.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	12.50	17.00	12.00	13.50
Copper, heavy, and wire	12.00	16.00	11.75	12.50
Copper, light, and bottoms	10.00	14.00	10.00	11.00
Lead, heavy	5.50	4.75	5.50	6.00
Lead, tea	4.50	3.75	3.75	5.00
Brass, heavy	7.00	10.50	8.00	12.50
Brass, light	5.50	7.50	5.00	6.50
No. 1 yellow brass turnings	7.00	10.00	6.00	6.75
Zinc	4.50	5.00	3.75	5.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	$33.00	$30.00	$33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	32.00
Chicago	29.00	31.00
Cleveland	30.00	35.00

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	80.00	90.00	49.00	70.00	45.00	60.00
Commercial	70.00	50.00	19.50	13.50	11.00	13.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York we quote the best two grades, although lower grades may be obtained at from $16 to $20.

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	—New York—		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+ $6.00	$1.50	List net	$2.25	+1.15	1.85
Hot pressed hexagon	+ 6.00	1.50	List net	2.25	+1.15	1.85
Cold punched hexagon	+ 6.00	1.50	List net	2.25	+1.15	1.30
Cold punched square	+ 6.00	1.50	List net	2.25	+1.15	1.30

Semi-finished nuts, ⅝ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50–10%
Chicago	40%	50%
Cleveland	50%	60-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	+ 20%	25%	20%
Larger and longer up to 1¼ in. by 30 in.	+ 20%	25%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... list Cleveland..... $2.50 Chicago..... $1.90

For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $5.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	+ 20%	25%	10%
Larger and longer up to 1 in. by 30 in.	+ 20%	20%	5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	20%	net	20%
New York	30%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	List Net	40%	30%
Tinned	List Net	40%	30%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.73 Pittsburgh..... $4.5

Structural, same sizes:
New York..... $7.10 Chicago..... $5.83 Pittsburgh..... $4.60

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	29.00	36.00	35.00
Brass	28.00	36.00	34.00

The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities from 10-25 lb., extra is 10c.; less than 10 lb., add 15–20c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $11.50 per 100 lbs.

In Cleveland—$10 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	— New York —			
	Current	One Year Ago	Cleveland	Chicago
White	15.00@17.00	13.00	16.00	11.00 to 14.00
Colored mixed	9.00@14.00	9.00–12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.00–2.10	$2.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	3.00	3.00	2.50
Chicago	2.00	2.75	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40–3.90	$3.90	$3.65
Philadelphia	3.65	3.65	3.87
Chicago	4.10	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	October 1	October 25	October 18
Prompt furnace	$16.00@$16.50	$16.00@$16.50	$16.00@$16.50
Prompt foundry	17.00@18.00	17.00@18.50	17.00@18.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

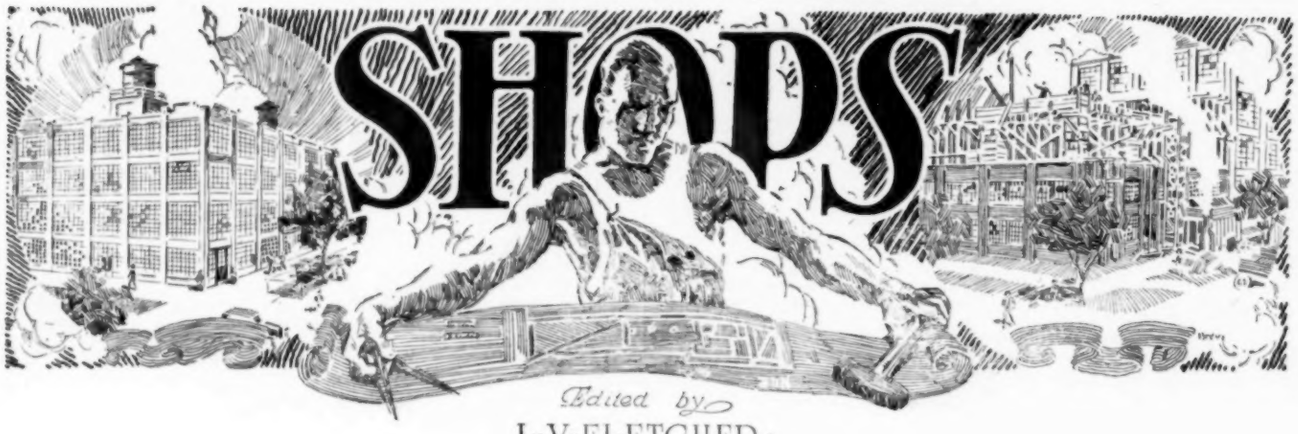
	—New York—		—Cleveland—		—Chicago—	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw in barrels, (5 bbl. lots)	$1.15	$2.15	$1.25	$2.50	$1.20	$2.37
5-gal cans	1.30	2.30	1.50	2.75	1.45	2.57
1-gal cans (6 to case)	1.40	.....	.....	.....	.....	.....

WHITE AND RED LEAD—Base price per pound:

	— Red —				— White —	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 1% discount. 2000 lb. lots less 10–20½% discount.

NEW *and* ENLARGED



Edited by
L·V·FLETCHER

Machine Tools Wanted

If in need of machine tools send us a list for publication in this column

Conn., Bridgeport—Curtis & Curtis Co., Railroad Ave. and Garden St.—one No. 16 Blanchard surface grinder, direct connected motor drive, and one universal dividing head.

Conn., Waterbury—The Waterbury Tool Co., East Aurora St.—one No. 2 Warner & Swasey hand screw machine with collets or equivalent.

R. I., Providence—H. R. Lowe, 507 Turks-head Bldg.—two spindle machine for drilling 1 in. cast iron, with minimum center to center of spindles of 3¼ in.

N. Y., Buffalo—The Buffalo Steel Car Co., 422 Fidelity Bldg., R. H. Parks, Purch. Agt.—machine shop equipment.

N. Y., Hornell—The Hornell Repair & Constr. Co.—$100,000 worth of machinery and equipment.

N. Y., New York (Borough of Manhattan)—J. D. Williams & Co., 2 Rector St.—radial drilling machines, one of 2 ft. 6 in. capacity, the other 3 ft. 6 in. capacity.

N. Y., Rochester—The Standard Automatic Machine Co., 860 Clinton Ave.—16 in. x 6 ft. lathe, cone drive, with all accessories and paper attachments.

Pa., Philadelphia—J. M. White, 1116 Olive St., manufacturer of wire braid—one 16 in. quick change lathe.

La., New Orleans—The Liberty Auto Service Co., Inc., 167-169 University Pl., G. F. Schminke, proprietor—planers, drill presses, motor driven lathes and accessories for its automobile and truck machine shop.

N. C., Greensboro—W. J. Westbrook Elevator Co., manufacturer of passenger and freight elevators—one 36 in. x 36 in. x 8 or 10 ft. iron planer with two heads on cross rail; one heavy duty lathe, 48 in. swing, 12 or 14 ft. bed, plain gear change for screw cutting, gearing face plate. Both machines belt drive (used).

Tenn., Knoxville—J. G. Duncan Co., 101 East Jackson St., manufacturers of machinery—miscellaneous equipment, including drill, crank shaper and engine lathe (used).

Va., Richmond—The Heisler Auto Repair Co., 309 North Laurel St.—bench arbor press and electric drill.

Ill., Chicago—Atchison & Topeka & Santa Fe Ry., Railway Exch. Bldg., M. J. Collins, Purch. Agt.—one 18 in. x 10 ft. engine lathe with 4 jaw independent steel chuck (new).

Ill., Chicago—The Edison Electrical Appliance Co., 5660 West Taylor St.—several punch presses with 28 x 36 in. bolster plate (or larger) 5 in. stroke, to handle 20 or 24 gal. steel, similar to Bliss No. 5 or No. 6 (new or used).

Ill., Chicago—The International Harvester Co., 606 South Michigan Ave.—one 8 punch press with 4 in. stroke (used).

Ill., Chicago—The Mid State Gummed Paper Co., 2433 South Robey St.—one lathe, 22 in. to 24 in. swing, 6 ft. centers (used).

Ill., Chicago—F. H. Parker Co., 1st Natl. Bank Bldg.—24 in. friction shaper (used).

Ill., St. Charles—The Faultless Iron Wks.—one power forming press, capacity 22 gage soft steel, 30 ft. between housings, arched type preferred, also one electric spot welding machine, small size (used).

Mich., Detroit—The Square D Co., 1400 Rivard St., manufacturers of safety switches—sheet metal working equipment, including presses and squaring shears.

O., Columbus—The Ohio Municipal Equipment Co., 315 Commerce Bldg., manufacturers of vacuum street sweepers, J. Rees, Genl, Mgr.—two lathes, about 18 in., three milling machines, three or four drill presses, two or three sheet metal working machines.

Wis., Marshfield—The Schlagenhaft Bros.—lathe for garage repair work.

Wis., Milwaukee—The Atlas Eng. Co., 3021 Lisbon Ave., manufacturers of concrete mixers, H. Zimmerman, Purch. Agt.—machine tools, including a drill press, millers, etc.

Wis., Milwaukee—The Pioneer Mfg. Co., 526 62d Ave., manufacturers of motor cycle accessories—one 28 in. or 30 in. turret lathe.

Wis., Milwaukee—A. R. Zwebell, 482 Milwaukee St., manufacturers of vulcanizing outfits—drill presses, lathes and probably additional machine tools.

Wis., Schleisingerville—The Zwebell Bros. Co.—machine tools, including lathes, drills, presses, etc.

Wis., Sheboygan—The Optenberg Iron Wks., 7th and Clara Aves.—machinery and equipment for its blacksmith and machine shops.

Wis., Sheboygan—The South Side Garage Co., South 12th and Indiana Sts.—garage equipment.

Kan., Baxter Springs—The Murdock Hardware Co.—lathes.

Kan., Pittsburg—A. L. Lamar, 1029 East 8th St., manufacturer of automobile trucks—lathes.

Mo., St. Louis—The Bremer Aluminum Corp., Boatmen's Bank Bldg.—four large blanking presses for handling sheet aluminum circles, capacity 20 in. diameter (new).

Tex., Houston—The Mack Mfg. Co.—machinery for the manufacture of rotary drilling outfits and oil field supplies for Dallas plant.

Cal., San Francisco—The Haywood Co., 1109 Hearst Bldg.—machinery for making wood screws, ½ in. long to 3 in. long, and Nos. 10 to 20; dies for making flat, round, countersunk, oval head screws; die making room equipment; all for use in China plant.

Ont., Strathroy—The Andrews Wire Co.—machinery for making special wire products.

Machinery Wanted

Mass., Worcester—G. A. Hair, 90 Maywood St.—dairy equipment.

Md., Baltimore—The Horn Ice Cream Co., 446 Aisquith St.—machinery for ice cream and ice manufacturing plants (new).

N. Y., Buffalo—J. M. Holland, 49 Layer Pl. (machinist)—hollow chisel mortiser.

N. Y., Livingston Manor—P. S. Johnson (woodworker)—band saw, 36 in. wheel.

N. Y., New York (Borough of Brooklyn)—The Findlay Mfg. Co., 100 Lexington Ave—one 66 in. cyclone dust collector.

N. Y., Rochester—C. P. Ford & Co., Commercial St., manufacturers of shoes, C. P. Ford, Purch. Agt.—one automatic "French" binding machine.

N. Y., Rochester—The Miller Cabinet Co., 310 Whitney St., manufacturers of cabinets—band sawyer and turner.

N. Y., Rochester—E. M. Trimble Co., 466 Central Ave.—one 6 in. belt edge sander, also small moulder.

N. Y., Rochester—The Van Toy Wks., 27 Francis St., manufacturers of toys, V. Van, Purch. Agt.—one power driven 16 in. jointer.

N. Y., Seneca Falls—The Wagner Rug Wks., manufacturers of carpets and rugs—power looms for carpet and rug weaving.

Md., Baltimore—H. B. Hearn Co., 41 South Gay St., manufacturers of sweeping compound chemical mixtures, etc.—sweeping compound mixing machine, electrically operated, to mix 1,200 barrels at one run.

La., New Orleans—The Crescent Battery Mfg. Co., 1506 Canal St.—catalogues pertaining to and machinery for the manufacture of lock corner boxes, batteries and battery parts, also electrical machinery and devices for making separators.

W. Va., Morgantown—The U. S. Window Glass Co.—$500,000 worth of machinery for glass plant, at Shreveport.

Ill., Chicago—The Illinois Glass Co., 402 West Randolph St.—special machinery.

Ind., Ft. Wayne—The Craig Biscuit Co., 115-121 Montgomery St.—$50,000 worth of machinery and equipment for bakery.

O., Columbus—J. Ohlen & Sons, one square west of west end of Buttles St.—one 42 in. three drum endless bed sander complete with all parts (used).

Wis., Sheboygan—The Sheboygan Dairy Products Co., South Water St.—equipment, etc., for dairy products factory in Fond du Lac.

Wis., Stevens Point—The Automatic Cradle Mfg. Co., 225 North 3d St.—woodworking machinery.

Wis., West Allis—The Baldwin Battery Box Co., 5801 Natl. Ave., F. Baldwin, Purch. Agt.—woodworking machinery.

Col., Kokomo—The Kokomo Mining Co., Exch. Bldg., Denver—second hand machinery for milling plant at Kokomo.

Minn., Little Falls—L. P. Pancratz & Co.—$15,000 worth of machinery for its tinshop.

Tex., Dallas—The Boedeker Mfg. Co., 521 South Ervay St.—machinery for the manufacture of ice cream.

Tex., Longview—T. Holliday—modern electrically driven sawmill machinery, planers, etc., for hardwood lumber mill at Ft. Worth.

Tex., San Antonio—The Southern Ice & Cold Storage Co.—machinery for its new unit.

Ont., Meaford—Reid & Gower—machinery and equipment for evaporating plant.

Ont., Wilton Grove—The Middlesex Milk Producers, R. R. 2, J. C. Nichol, Pres.—machinery and equipment for its London plant.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—P. Esposito, 420 North Ave., will soon award the contract for the construction of a 1 story, 40 x 80 ft. and 10 x 10 ft. garage on North Ave. Estimated cost, $10,000. J. L. Vannucci, 1024 Main St., Archt.

Conn., Hartford—The Bd. of Contract and Supply has awarded the contract for the construction of a 2 story, 50 x 125 ft. machine shop on John St. Estimated cost, $76,729. Noted July 29.

Conn., Hartford—M. Delaney, 1075 Main St., will soon award the contract for the construction of a 1 story, 75 x 100 ft. garage on Albany Ave. Estimated cost, $30,000. F. C. Walz, 407 Trumbull St., Archt. Noted Sept. 30.

Conn., Hartford—R. Piccollo, 665 Albany Ave., will build a 1 story, 50 x 70 ft. garage on Albany Ave. Estimated cost, $10,000.

Conn., New Haven—H. D. Jackson, 1098 Chapel St., will build a 1 story, 52 x 87 x 89 ft. garage and service station on Whalley Ave. and Blake St. Estimated cost, $25,000.

Conn., New Haven—H. Kasden, 19 Howe St., has awarded the contract for the construction of a 1 story, 50 x 80 ft. addition to its iron foundry on Mill River St. Estimated cost, $10,000.

Conn., New Haven—The New Haven Dairy Co., 201 Hazel St., has awarded the contract for the construction of a 2 story, 70 x 150 ft. garage on Hazel St. Estimated cost, $80,000.

Me., Auburn—The Darling Automobile Co., 15 Turner St., will soon award the contract for the construction of a 1 story, 80 x 100 ft. garage and service station on Franklin St. Estimated cost, $40,000. H. S. Coombs, 11 Lisbon St., Lewiston, Archt.

Mass., Boston—The Amer. Can Co. 120 Bway., New York City, plans to build a 1 story factory here. Estimated cost, $250,000. Private plans.

Mass., Lynn—The General Electric Co., 84 State St., has awarded the contract for the construction of a 1 story, 160 x 300 ft. addition to its factory. Estimated cost, $150,000. Noted Oct. 21.

Mass., Mansfield—The S. W. Card Mfg. Co., manufacturers of dies and taps, has awarded the contract for altering its factory. Estimated cost, $25,000.

Mass., Marboro—The Standard Oil Co. of New York, 50 Congress St., Boston, will build a 1 story garage on Maple St., here. Estimated cost, $18,000.

Mass., Millbury—P. Lynch, Elm St., plans to build a 1 story garage on Elm St. Estimated cost, $15,000. S. H. Pilcher & Co., 44 Front St., Worcester, Archt.

Mass., Somerville (Boston P. O.)—The Amer. Tube Wks., 440 Somerville Ave., has awarded the contract for the construction of a 1½ story addition to its drawing mill. Estimated cost, $75,000. Noted Oct. 14.

Mass., Worcester—T. Smith & Co., 288 Grove St., has awarded the contract for the construction of a 1 story, 34 x 62 ft. factory for the manufacture of bolts, etc. Estimated cost, $12,000. Noted Sept. 24.

MIDDLE ATLANTIC STATES

N. Y., Buffalo—The Buffalo Steel Car Co., 422 Fidelity Bldg., has acquired a 40 x 60 ft. building adjoining plant on Walden Ave., and plans to equip same as machine shop. R. H. Parks, Pres.

N. Y., New York (Borough of Brooklyn)—The Brownsville Assn., c/o S. Millman, Archt., 26 Court St., will build a 1 story, 100 x 100 ft. garage on Rockaway Ave. Estimated cost, $35,000. Work will be done by day labor.

N. Y., New York (Borough of Brooklyn)—Shapiro & Aronson, c/o H. J. Murick, Archt. and Engr., 772 Bway., New York City, will build a garage and factory on Glenmore Ave.

N. Y., New York (Borough of Bronx)—B. Smith c/o Dunnigan & Crumley, Archts. and Engrs., 394 East 150th St., will build a 1 story, 20 x 150 ft. garage on City Island Ave. and Ditmas St. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan)—O. J. Mayer, 2085 5th Ave., will build a 1 story, 50 x 150 ft. garage on Park Ave. and 173d St. Estimated cost, $30,000.

N. Y., Rochester—The Rochester Castings Corp. will soon award the contract for the construction of a 1 story, 120 x 400 ft. factory. J. C. Ancona, 305 Cutler Bldg., Engr.

Pa., Johnstown—W. E. Oaks, 919 Franklin St., has awarded the contract for the construction of a 2 story, 50 x 120 ft. garage and office building. Estimated cost, $27,000.

Pa., Pittsburgh—The Pittsburgh Malleable Iron Co., 57th St. and the Allegheny River, plans to build a 202 x 322 ft. foundry. Estimated cost, $500,000. F. Chase, 645 North Michigan Ave., Chicago, Arch.

SOUTHERN STATES

La., New Orleans—The Amer. Can Co., 120 Bway., New York City, plans to build a factory here. Estimated cost, $250,000. Private plans.

La., New Orleans—The Peer Garage, 313 South Rampart St., G. W. Christman, Prop., catalogs and prices on drill presses 12 in. lathe, and auto tools.

N. C., Greensboro—The Carolina Steel and Iron Co. will build an 80 x 180 ft. foundry. Estimated cost, $25,000.

MIDDLE WEST

Ill., Chicago—The Alemite Die Castings & Mfg. Co., 341 West Chicago Ave., has awarded the contract for the construction of a 1 story, 150 x 270 ft. factory on Washtenaw and Belmont Aves. Estimated cost, $150,000.

Ill., Chicago—The Mem Motor Corp., c/o Dubin & Eisenburg, Archts., 139 North Clark St., has awarded the contract for the construction of a 1 story, 50 x 170 ft. auto sales and service building on Michigan Ave. near 31st St. Estimated cost, $25,000.

Ind., Scottsburg—The Interstate Pub. Service Co., 510 Bd. of Trade, Indianapolis, is having plans prepared for the construction of shops and car barns here. Estimated cost, $300,000. Private plans.

O., Cleveland—J. Babin, 827 Superior Ave., is having plans prepared for the construction of a 2 story, 60 x 120 ft. garage and commercial building on Superior Ave. and East 105th St. Estimated cost, $100,000. N. Petti, Williamson Bldg., Archt.

O., Cleveland—The Cleveland Tractor Co., Lamb Ave., has awarded the contract for the construction of a 1 story, 24 x 70 ft. addition to its factory. Estimated cost, $10,000.

O., Cleveland—C. B. Dawson, 4314 Payne Ave., steel contractor, plans to build a 1 story factory. Estimated cost, $20,000.

O., Cleveland—P. DeLorenzo, 303 Penn Sq. Bldg., will build a 1 story, 30 x 50 ft. garage at 2501 East 29th St. Estimated cost, $10,000.

O., Cleveland—The Laundryette Mfg. Co., manufacturer of washing machines. 1190 East 152d St., plans to build a 1 story, 30 x 52 ft. garage. Estimated cost, $10,000. Private plans.

O., Cleveland—G. Zellers, Jr., 5803 Woodland Ave., manufacturer of furnaces, has purchased a site at 1767 East 12th St., and plans to build a 1 story work shop and office building.

O., Dayton—The Computing Scale Co., Hoffman Ave., has awarded the contract for the construction of a 5 story factory for the manufacture of scales. Estimated cost $150,000.

Wis., Amery—The Amery Auto Co. has awarded the contract for the construction of a 50 x 150 ft. garage.

Wis., Jackson—The Meehan Mfg. Co., 709 M. & M. Bldg., is having preliminary plans prepared for the construction of a 1 story, 80 x 100 ft. factory, on Main St., for the manufacture of farm lighting plants. Cost between $50,000 and $100,000. A. E. Mitterhauser, 51st St., Milwaukee, Archt.

Wis., Kaukauna—Molock Co. has awarded the contract for the construction of a 1 story, 80 x 200 ft. foundry and machine shop. Estimated cost, $100,000.

Wis., Kenosha—D. Nelson, 71 Victoria St., has awarded the contract for the construction of a 2 story, 50 x 62 ft. garage. Estimated cost, $11,000.

Wis., Milwaukee—M. L. Popp, 1344 Natl. Ave., is building a 1 story, 30 x 130 ft. addition to his garage. Estimated cost, $10,000.

Wis., Oconomowoc—W. S. King is having plans prepared for the construction of a 1 story, 60 x 90 ft. garage and salesroom. Estimated cost, $20,000. Parkinson & Dockendorff, LaCrosse, Archts.

Wis., Schleisingerville—Zwebell Bros. Co. will soon award the contract for the construction of a 1 story, 60 x 150 ft. factory on Main St., for the manufacture of vulcanizing outfits. Estimated cost, $100,000. Judell & Bogner, 415 Milwaukee St., Archts.

Wis., Sheboygan—The Optenberg Iron Wks., 7th and Clara Aves., will build blacksmith and machine shops.

Wis., Sheboygan—The South Side Garage Co., South 12th and Indiana Sts., will soon award the contract for the construction of a garage on Indiana St. Estimated cost, $75,000. Private plans. Noted Sept. 16.

WEST OF THE MISSISSIPPI

Kan., Baxter Springs—The Murdock Hardware Co., has had plans prepared for the construction of a 1 and 2 story, 50 x 110 ft. manufacturing plant and office building along the tracks of the Frisco R.R. Estimated cost, $15,000. A. C. Callin, 413½ Bway., Pittsburgh, Archt.

Kan., Pittsburgh—A. L. Lamar, 1029 East 8th St., will receive bids until Nov. 15, for the construction of a 1 story machine shop and factory at 1031 East 8th St., for the manufacture of automobile trucks. Estimated cost, $12,000.

Minn., Little Falls—L. P. Pancratz & Co. plans to remodel tin shop.

Mo., St. Louis—The St. Louis Screw Co., Clarence and Bulwer Sts., will build a 1 story, 160 x 160 ft. factory, at 6912 North Bway.

Tex., Dallas—The Mack Mfg. Co., Houston, is having plans prepared for the construction of a factory here, for the manufacture of cable tools. Estimated cost, $1,000,000.

CANADA

Ont., Strathroy—The Andrews Wire Co. plans to build an addition to its factory. Estimated cost, $60,000.

Ont., Toronto—The Northern Aluminum Co., Sterling Rd., has awarded the contract for the construction of a plate mill here. Estimated cost, $200,000.

Que., Montreal—The Mountain Street Garage Co., Ltd., will soon receive bids for the construction of an addition to its garage. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Mass., Boston—K. J. Quinn & Co., Inc., 80 Batterymarch St., will soon award the contract for the construction of a 2 story, 30 x 60 ft. addition to its factory for the manufacture of shoe polish. Cost, $18,000 and $20,000. Private plans.

Mass., West Medford (Boston P. O.)—The Amer. Woolen Co., 245 State St., Boston, has awarded the contract for the construction of a plant, on Boston Ave., to replace the one which was recently destroyed by fire. Estimated cost, $250,000.

Mass., Worcester—G. A. Hair, 90 Maywood St., has awarded the contract for the construction of a 1 story, 30 x 50 ft. dairy plant, on Park Ave. Estimated cost, $12,000.

Mass., Wrentham—The Commonwealth of Massachusetts, State School Dept., Boston, has awarded the contract for the construction of a 1 story, 50 x 70 ft. cold storage building, at the State School here. Estimated cost, $50,000. Noted Sept. 2.

N. H., Tilton—The General Optical Co., Mt. Vernon, N. Y., plans to build an addition to its factory here, for the manufacture of optical goods. Woodwell & Lesser, 501 5th Ave., New York City, Archts.

MIDDLE ATLANTIC STATES

Md., Baltimore—H. B. Hearn Co., 41 South Gay St., plans to build a plant for the manufacture of chemical mixtures, etc.; electrically operated to turn out about 25 barrels of sweeping mixtures daily. H. B. Hearn, Pres. and Mgr.

Md., Baltimore—The Horn Ice Cream Co., 446 Aisquith St., plans to build an ice cream plant to have a daily capacity of 20,000 gal., and an ice manufacturing plant to have the daily capacity of 60 tons, on Low and Aisquith Sts. Estimated cost, $300,000.

N. J., Maurer—The Barber Asphalt Paving Co., 233 Bway., New York City, has awarded the contract for the construction of a 2 story asphalt plant here.

N. Y., New York (Borough of Brooklyn)—J. E. Berwind, 1 Bway., New York City, has awarded the contract for the construction of a 2 story printing plant, on Sands St., here. Estimated cost, $50,000.

N. Y., New York (Borough of Queens)—The Forest Box & Lumber Co., Long Island City, will build a 1 story factory at 420 Oakland St. Estimated cost, $35,000.

Pa., Philadelphia—Baeder & Adamson Co., Richmond and Alleghany Sts., manufacturers of glue, will alter and build an addition to its factory. Estimated cost, $56,000.

Pa., Philadelphia—The Keystone Table Top Co., c/o L. B. Rothchild, Archt. and Engr., 1225 Sansom St., is having plans prepared for the construction of a 2 story, 35 x 140 ft. factory, on Callowhill and 3d Sts.

Pa., Pittsburgh—The Antonoff Bakery Co., c/o McCormick Co., Engrs. and Archts., Century Bldg., will soon award the contract for the construction of a 2 story, 15 x 40 ft. and 38 x 44 ft. addition to its bakery on Spring Gardens Ave. Estimated cost, $25,000. Noted Oct. 14.

Pa., Scranton—The Long Handkerchief Co., 1012 North Washington Ave., is building the second unit of its plant, to be 3 story, 50 x 100 ft. Estimated cost, $75,000.

SOUTHERN STATES

La., Shreveport—The U. S. Window Glass Co., Morgantown, W. Va., has purchased a site here and will build a window glass factory. Estimated cost, $500,000.

MIDDLE WEST STATES

Ill., Chicago—The Illinois Glass Co., 402 West Randolph St., has awarded the contract for the construction of a 1 and 2 story, 215 x 270 ft. factory, at 2601 North Crawford Ave.

Ill., Chicago—Stearns Bros. & Co., 619 South LaSalle St., will soon award the contract for the construction of a 2 story, 100 x 160 ft. addition to its printing plant, on East Huron St. and Fairbanks Court. Estimated cost, $200,000. Berlin, Swern & Randall, 19 South LaSalle St., Archts.

Ill., Mount Vernon—The Davidson Flour Co., St. Louis, Mo., has awarded the contract for the construction of a 4 story, 80 x 150 ft. plant here. Estimated cost, $150,000.

Ind., Ft. Wayne—The Craig Biscuit Co., 115-121 Montgomery St., plans to build a bakery on West Main St. and the St. Marys River. Estimated cost, $150,000.

Mich., Kalamazoo — The Kalamazoo Loose Leaf Binder Co., 314 West Kalamazoo St., will soon award the contract for the construction of a 4 story, 100 x 140 ft. addition to its factory. N. H. Stuart Purch. Agt.

O., Cleveland—Orban & Hunt, 9512 Cedar Ave., canners, plan to build a 2 story, 60 x 80 ft. factory and warehouse. Estimated cost, $60,000. Carter, Richards Griffith Co., Illuminating Bldg., Archts. and Engrs.

O., St. Bernard (Cincinnati P. O.)—The Worthington Pump and Mchy. Co., 115 Bway., New York City, will soon award the contract for the construction of a 1 story, 50 x 75 ft. addition to its plant here.

Wis., Fond du Lac—The Sheboygan Dairy Products Co., South Water St., Sheboygan, will soon award the contract for the construction of a 2 story, 60 x 113 ft. dairy products factory, on West Division St., here. Estimated cost, $100,000. B. E. Mehner, 63 Division St., Archt.

Wis., Fond du Lac—The Wisconsin Milk Co. will build a 2 story, 60 x 113 ft. butter, milk and ice cream plant. Estimated cost, $60,000.

Wis., Kewanee—The Wisconsin Shipbuilding & Navigation Co. is building a shipyard here. Estimated cost, $62,000. H. Greiling, Green Bay, Genl. Mgr.

Wis., Milwaukee—G. Kashou, 432 Jefferson St., is having plans prepared for the construction of a 2 story, 45 x 65 ft. rug cleaning plant. C. W. Valentine, Bway. Bldg., Archt. and Engr.

Wis., Sheboygan—The United Fruit Package Mfg. Co., 701 North 8th St., has purchased a site near here and plans to build a 2 story, 60 x 150 ft. factory for the manufacture of fruit packages. Estimated cost, $50,000.

WEST OF THE MISSISSIPPI

Kan., Wichita — The Standing Grain Thresher Co., Union Natl. Bank Bldg., plans to build a thresher factory. Estimated cost, $250,000. C. S. Gibbens, Nickerson, Secy.

Minn., Mankato—The Carney Cement Co. is having plans prepared for the construction of a cement plant, north of here, to include a mill building, machine shop, blacksmith shop, chemists building, garage, warehouse, coal hoppers and 16 steel kilns, 60 ft. high and 18 ft. diameter. Estimated cost, $150,000. R. K. Meade, 11 East Fayette St., Baltimore, Md., Engr.

Minn., Ottertail—The Ottertail Creamery Assn. plans to build a 2 story, 54 x 62 ft. creamery. Estimated cost, $50,000. M. Buetow and C. Kampfer, 106 West Central Ave., St. Paul, Archts.

Mo., St. Louis—The C. Nelson Mfg. Co., 23d and Division Sts., has awarded the contract for the construction of a 2 story, 53 x 83 ft. addition, to its ice cream manufacturing plant, at 2308 Division St. Estimated cost, $12,000.

Mo., St. Louis—The Tip Top Bottling Co., 1432 North Jefferson Ave., has awarded the contract for the construction of a 1 story, 30 x 169 ft. factory. Estimated cost, $7,000.

Tex., Austin—The Home Ice & Cold Storage Co., 3d St., is having plans prepared for improving its present plant and building additions to same. Estimated cost, $200,000. A. M. Fitzpatrick, Pres. and Genl. Mgr.

Tex., Dallas—The Boedeker Mfg. Co., 521 South Ervay St., plans to build a 2 story plant, on the corner of Ervay and Pocahontas Sts., for the manufacture of ice cream. Estimated cost, $100,000.

Tex., Dallas—The Gulf Refining Co., 315 Sherman St., has had plans prepared for the construction of a 3 story distributing plant to include a machine shop, etc. Estimated cost, $100,000.

Tex., Ft. Worth—T. Holiday, Longview, is having plans prepared for the construction of a lumber mill, storage yards, etc., at 800 North Houston St., here. Estimated cost, $250,000.

Tex., San Antonio—The Southern Ice & Cold Storage Co. plans to build a 20,000 ton ice storage warehouse. Estimated cost, $250,000. M. Postlewaite, Mgr.

CANADA

Ont., London—The Middlesex Milk Producers, R. R. 2, Wilton Grove, plans to build a dairy, creamery and milk plant here. Estimated cost, $250,000. J. C. Nichol, Pres.

Que., Montreal—The Canada Cement Co., Herald Bldg., Craig St., W., plans to build a 10 story plant. Estimated cost, $450,000. Ron & MacDonald, Belmont St., Archts.

Que., Montreal—Wisers Distillery, Ltd., will soon receive bids for the construction of a plant. Estimated cost, $100,000.

Que., St. Therese—The Dominion Furniture Manufacturers, Ltd., plan to build an addition to their plant. Estimated cost, $125,000.

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